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COLOSSUS, OF THE BRITISH NAVY.

The keel of the Colossus was laid at Portsmouth dockyard in 1879. She is a steel ship, armor plated with 18 inches thickness of armor, carrying four 42 ton guns in two turrets, and four 6 inch guns. She is a sister ship to the Majestic, which was built at Pembroke at about the same period. She is 325 feet in length between the perpendiculars; extreme breadth, 68 feet; draught of water, 25 feet 9 in.; displacement 9,150 tons. Her engines have 6,000 indicated horse power, and she carries 950 tons of coal. Our illustration is a reproduction of a photograph of the Colossus taken only a few weeks ago.

Boys and Trades.

A short time since a correspondent of a Southern paper, who evidently knew how to wield something besides his pen, and this he uses to a good purpose, made some observations, from which the *Jewelers' Journal* quotes as follows:

"I believe," says the writer, "in schools where boys can learn trades. Peter the Great left his throne and went to learn how to build a ship, and he learned from stem to stern, from hull to mast, and that was the beginning of his greatness. I knew a young man who was poor and smart. A friend sent him to one of these schools up North, where he stayed two years and came back as a mining engineer and a bridge builder. Last year he planned and built a cotton factory, and is getting a large salary. How many college boys are there in Georgia who can tell what kind of native timber will bear the heaviest burden, or why you take white oak for one part of a wagon and ash for another, and what timber will last longer under water and what out of water? How many know sandstone from limestone, or iron from manganese? How many know how to cut a rafter or brace without a pattern? How many know which turns the faster—the top of a wheel or the bottom—as the wagon moves along the ground? How many know how steel is made, and how a snake can climb a tree?

"How many know that a horse gets up before and a cow behind, and the cow eats grass from her and the horse to him? How many know that a surveyor's mark on a tree never gets any higher from the ground, or what tree bears fruit without bloom?

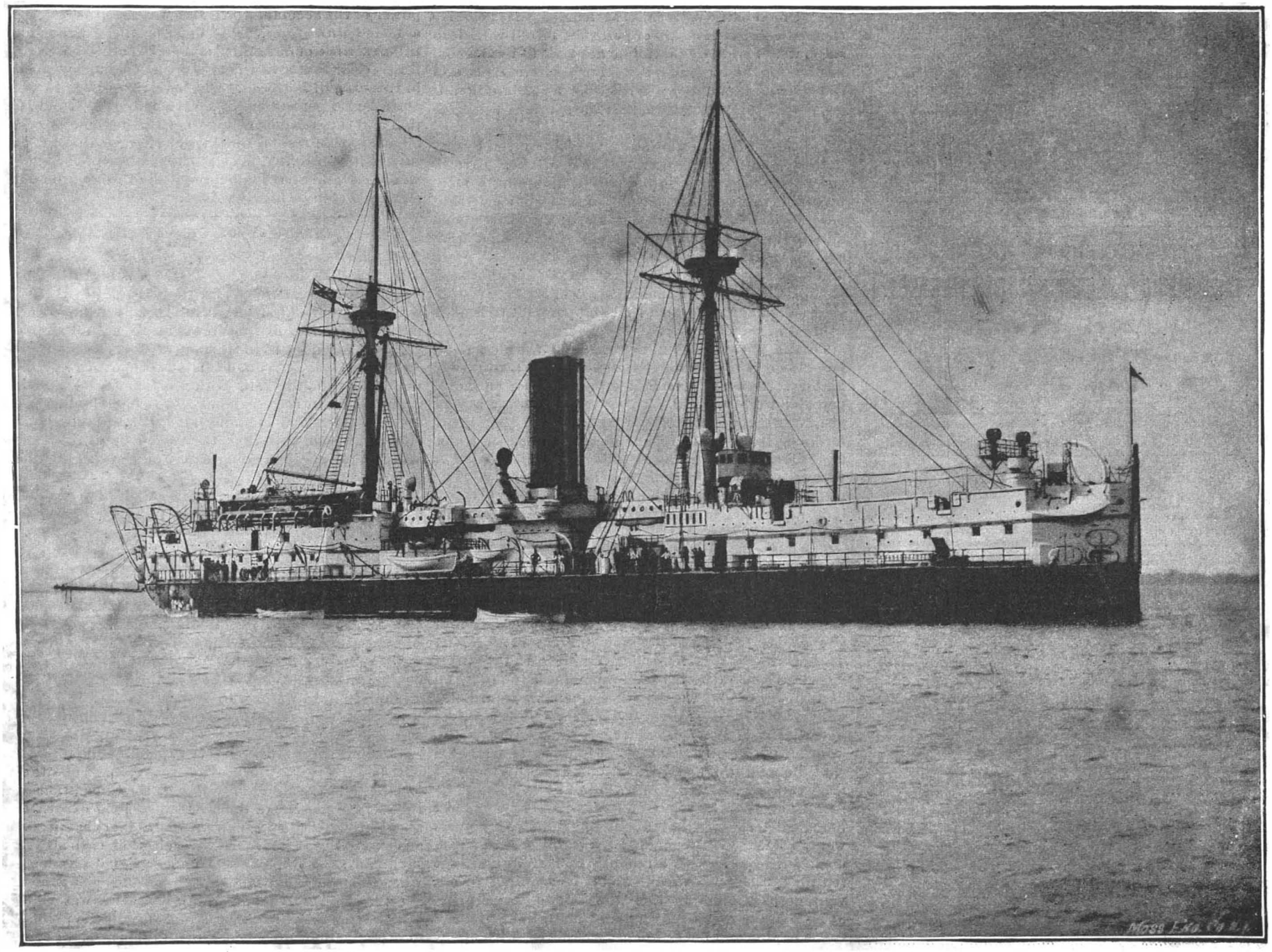
"There is a power of comfort in knowledge, but a boy is not going to get it unless he wants it bad, and that is the trouble with most college boys, they don't want it. They are too busy, and haven't got time. There is more hope of a dull boy who wants knowledge than of a genius, for a genius generally knows it all without study. These close observers are the world's benefactors."

Bellite.

This explosive is inexpensive, easily made, and not liable to spontaneous explosion, but it develops, when intentionally fired by a spark, a force thirty-five times as great as gunpowder, and greater by 15 per cent than that of guncotton. To make bellite, benzine is treated with a mixture of sulphuric and nitric acids. The sulphuric acid should be of the fuming kind, which is nearly free from water; and the proportion of nitric acid should be somewhat larger than that of the other. By keeping the mixed acids in contact with the benzine for some time, at a temperature rather above that of boiling water, the benzine is converted into trinitrobenzine, which is washed, so as to clear away all traces of free nitric acid, and then mixed with nitrate of ammonia, which is the common substance used for producing nitrous oxide gas. The mixture, if the free acid is thoroughly washed away, is very stable. Unlike dynamite, which explodes so readily from concussion that in heavy blasts only every tenth cartridge is fired directly, the others being all exploded with certainty by sympathy, a charge of bellite cannot be ignited by a blow or by friction. A shell charged with it strikes its object without exploding, unless a fulminating fuse is attached to it, and a magazine filled with it may be struck by projectiles without danger. When applied to use, however, its force is enormous. A charge of less than half an ounce, placed in a mortar behind a shell weighing ninety pounds, projected the shell to a distance of nearly four hundred feet, and its efficacy in detaching rock in a quarry proves greater than that of any nitroglycerine compound.

A State Cannot Compel Drummers to Pay Tax.

In the matter of interstate commerce, the United States are but one country, and are and must be subject to one system of regulations, and not to a multitude of systems; the doctrine of the freedom of commerce, except as regulated by Congress, is so firmly established, that it is unnecessary to enlarge further upon the subject. And the law of Tennessee requiring a drummer, before he can sell goods by sample in that State, to pay a tax and take out a license, is unconstitutional and void. Sabine Robbins *vs.* the Taxing District of Shelby County, Tennessee.



TWIN SCREW, DOUBLE TURRET BRITISH WAR SHIP COLOSSUS.

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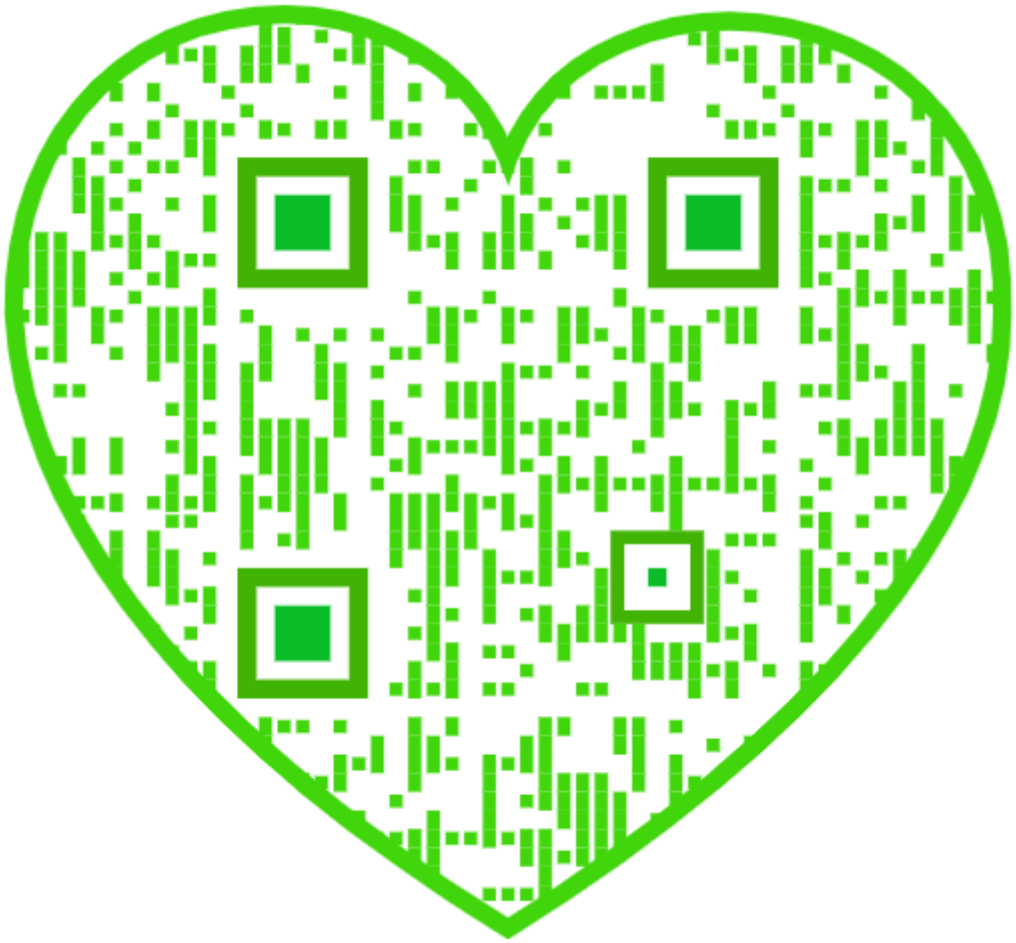

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NEW YORK, SATURDAY, MAY 14, 1887.

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ELECTRIC ACCUMULATORS.

At the present time, much interest is excited in the electrical world by storage batteries. When first introduced as a practical apparatus, some years ago, they were hailed as providing for the storage of electricity, which was considered a great desideratum. For a while interest in them weakened, but it has revived again. Their acknowledged failure in returning the full quantity of electricity with which they are charged is offset by the consideration that they can be charged from the cheapest possible source of that form of energy, the dynamo. This loss of electricity is due to several causes, some, doubtless, unknown as yet. In charging accumulators, the current has to be maintained at a tension slightly greater than that producible by the discharge. Otherwise the battery would discharge itself through the dynamo. Hence, there is an inevitable loss in voltage. This does not only apply to the natural voltage of the cell. There is a "spurious" voltage, as Prof. Forbes has recently termed it, to contend against. The regular electro-motive force being 2 volts, the initial tension of the cell is sometimes as high as 2¼ volts, and the charging has to be done against this, indicating in such a case a waste of about eleven per cent of the electro-motive force of the charging current. This is not the only loss, for the tension is not alone reduced, but there is also a fall in quantity or intensity. The ampere hours suffer in somewhat the same proportion.

Thus, tests of Faure accumulators have given the following results in electricity returned: Return in quantity (ampere hours), 84·34 per cent; return in electrical work (watts hours), 62·44 per cent; return in mechanical work (foot pounds), 46·50 per cent. The figures in the three cases are the results obtained by Messrs. Monnier & Guitton with Faure-Sellon-Volckmar batteries in October, 1883. They are still considered authoritative. For working figures, 90 per cent, 60 per cent, and 40 per cent are sometimes taken.

The cause of these different losses is not yet satisfactorily ascertained. The spurious electro-motive force has been attributed to hydrogen bubbles sticking to the positive plates. The loss in quantity may be due to local action between the metallic grids and the peroxide. The perfect contact of plates and peroxide is advocated by some as the panacea for the latter. More than one inventor has endeavored to do away with the lead supports in the negative plate, and to substitute therefor a solid mass of lead peroxide. One of the batteries now claiming the public's attention in England, the "Union battery," is thus constructed.* Its negative element consists of a slab of peroxide, mixed with lead sulphate. Strips of platinum are used to form a connection for the binding posts. For positive, a plate of spongy lead is adopted. With such a combination, it is asserted by Prof. Forbes that the spurious voltage is extremely low.

Yet the return question seems not fully solved by any battery, and it seems doubtful if it will be. Investigators are now most interested in obtaining a more favorable ratio of total weight of battery to electrical energy yielded. It is here that one of the many anomalies of the storage battery manifests itself. In a primary battery the zinc can be dissolved to the last grain and be rigorously accounted for. In the usual forms of storage battery only a small portion of the active substances, spongy or formed lead and peroxide of lead, is utilized in the discharge.

Thus, a determination was made of the amount of peroxide reduced during the discharge of a lithanode battery. Two and one-half ounces out of eleven of peroxide were reduced. This gives a basis for a very disadvantageous ratio of weight to power. The other forms of battery in which a metallic frame or grid is used to support the peroxide present a similar, together with an additional, reason for the discrepancy. The metal frame is all idle material, if, as already suggested, it is not worse, in forming the positive element in a destructive local circuit.

The advertised weights of cells of two leading accumulator companies, with their quantity of discharge, illustrate this well. One cell, weighing 125 pounds, is stated to deliver 350 ampere hours with a discharge period of 10 hours. Another cell, weighing thirty-four pounds, is credited with 150 ampere hours in 4¼ hours. The electro-motive force being two volts, the above reduced to electrical horse power represent 133 pounds and 84 pounds of dead weight respectively per hour horse power. Taking the rate of delivery into consideration, in each case about $\frac{1}{10}$ horse power per hour is maintained. Practically speaking, it must be remembered that the weight of a storage battery does not represent the weight of an engine only, but of an engine and its fuel. Thus, to develop one electrical horse power hour, we may say that about one hundred pounds would suffice. This compares favorably with a steam engine and boiler with an hour's fuel and water, but ten times the above weight would be required to advantageously maintain this rate. Again, suppose ten hours horse power were wanted. The same weight of steam engine and boiler would be required, with about forty-five pounds of coal additional. But of the storage battery, ten times the weight would be required, or about nine hundred pounds additional. Not only have the volt-amperes to be considered, but the period of discharge, a practical factor settled by experience only, has to be allowed for. The extremely low resistance cannot be taken full advantage of. The rapid discharge is wasteful and destructive of the plates.

To the reduction of this dead weight, electrical engineers are now devoting themselves. One way of lessening the trouble in house service may be mentioned. To introduce private installations in cities, it is proposed to renew the plates as fast as exhausted. This method does away with the weight of the cells. Only the plates are transported, the cells remaining in the house. A central station would be fitted up to recharge and distribute. In the lighter of the batteries just cited, the plates for an electrical horse power hour would weigh 67 pounds, according to the figures of the company supplying it. One gross ton of such plates would represent nearly 34 electrical horse power hours. The lithanode plates, it is claimed, give still lower weights. For them 56 horse power hours per ton is claimed. This reads very much as if a one horse engine burned forty pounds of fuel an hour, or rather as if the coal contained so little combustible matter that forty pounds were required to keep a one horse engine going for an hour.

The above trouble due to dead weight affects transportation, and use in vehicles and boats, but does not enter to the same extent into installations where a dynamo is included in the plant. Here the weight is of less moment, yet any move to reduce it would be welcomed. Another peculiarity of the storage battery, and one already alluded to, stands in the way of what might seem an obvious method of reduction. A small battery frequently charged and discharged at a high intensity would solve the problem in at least some cases. But the storage battery cannot be so discharged with economy. For the ends of efficiency and durability the rates already instanced in the case of two particular forms of accumulators cannot be exceeded. In practice the lighter one of the two is used at a far less intensity of current than that given, or about one ampere per hour to two pounds of battery. No more startling spectacle in electricity than the work of a storage battery on a circuit of infinitesimal resistance can be witnessed. To see a heavy copper wire a foot or more in length heated to full redness by a secondary battery no larger than a pocket book gives an exalted idea of the power of the accumulator. But wonderful as it is, it is a mere *tour de force*. It is done at the expense and utter sacrifice of durability and efficiency.

It is clear that a vast field is open for improvements in this class of batteries. The electrodes need to possess a larger percentage of active material. Polarization and the spurious voltage need reduction. Finally, a battery that can be quickly discharged without injury to its durability, even at the sacrifice of efficiency, would certainly have a definite field of work, where its services would be highly valued.

* For description of this battery see SUPPLEMENT, No. 598.

HEADWAY OF GREAT SHIPS.

To the Editor of the Scientific American:

In vol. liii., No. 10, page 144, I saw an article under the heading, "Speed on the Ocean," in which it says: "A great ship while at full speed will run several miles before she can be brought to a full stop or turned a few degrees to the port or starboard."

Some time ago I related this statement to a friend of mine who is in the New York Custom House, and he declared it untrue, and has since made inquiries of several officers and captains, and they tell him such a statement is absurd—that they can stop their vessels when at full speed in going three or four times their length.

I write this, asking you, for the satisfaction of others as well as myself, to ascertain the facts if possible.

WILL. P. SESSIONS.

Brandon, Vt., April 26, 1887.

[The question as to how far a fast steamer would run with engines stopped was referred to Mr. Nash, the secretary of the Board of Pilots. Mr. Nash has been connected with the Board for fifteen years, and been present at many of the trials which pilots are subjected to for running ships ashore and like mishaps. He calculated that if the engines of a ship running 19 knots an hour in dead water were stopped and reversed, she would not begin to gather sternway until she had covered a distance of at least two miles, and perhaps even as much as three miles. Two of the best pilots of the port being called into the office, each made separate estimates, and the result agreed with the calculations of the secretary. One of them said that long experience aboard these fast ships had proved to him that if two such vessels were approaching each other, each making 19 knots an hour, and the danger signal was heard when they were four miles apart, it could not avail to avert the impending danger, if the weather was thick, because they could not be stopped until the point of meeting had been reached, and all their masters could do would be to "trust to luck" to slip safely by.

Another pilot gave the following instance of the diffi-

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culty of stopping a big iron tramp steamer: "Her master told me that once, when he had the ocean all to himself, he determined to make some experiments, so that, should he ever be called up and questioned by the Board of Trade Committee, he would be prepared to answer intelligently. His ship had low power engines, and could not do much better than 12 knots an hour in dead water. While running her at full speed, he ordered the engines stopped and reversed, and with his log and time piece he discovered that she ran fully four knots before she began to gather sternway. As to the sluggish manner in which these long, wedge-shaped ships answer their helms, it seems unnecessary to say anything, because their defects in this respect are so well known. We had an instance of this only last week, when the large Cunard steamship Aurania, with plenty of sea room and fair warning at the helm when a long way off, could not weather the Southwest Spit at the entrance to this harbor, because the current was a little stronger than usual on account of the spring tides.

The captain of the Aurania says he can stop his ship when running at full speed in a distance not much over a mile, and an officer of the Alaska calculated the distance at a mile and a half.]

Many Items of Interest.

The newspaper *Fire and Water*, devoted to fire protection, water supply, etc., in cities, relates a singular accident, which came near being serious. In a dyeing establishment near this city a man was cleaning a flannel gown in a tub of benzine, fully 100 feet removed from a flame of any kind. He was simply rubbing the garment with his bare hands, when, as he describes it, "suddenly the whole tubful of stuff went up in a blaze," and he escaped death or serious injury only by an instinctive and instantaneous backward leap. The friction caused by handling the flannel generated electricity, which ignited the vapors arising from the benzine. This, the editor says, is in its details the first instance of the kind which has yet come to our knowledge, and the fire having been quickly extinguished by the employes, would probably never have been reported had not one of them casually mentioned it.

The *American Architect* relates the following incident of England's architect, Mr. John Ruskin. The other day some incautious Christians, who had built a cheap mission chapel in the suburbs of London, applied to this great man to help them pay for it. Instead of money they received some advice, of greater value, probably, than any pecuniary gift that the critic could bestow. "Why," he asked them, "did they build churches that they could not pay for?" "Why did not they preach behind the hedges, rather than run into debt?" "And of all manner of churches thus idiotically built," he was kind enough to add, "an iron church was to him the damnablest." Mr. Ruskin is said to have just joined the Roman Catholic Church, and this may account for his asperity in talking to evangelical Protestants; but the story shows how cautious one must be in dealing with such persons.

The *Real Estate Record*, of this city, repeats what it has said before, that there are the very best reasons for believing that the New York Central Railroad has decided to build an underground railroad from the Grand Central Depot to the Brooklyn Bridge. The tunnel in which the tracks will be laid will run under Elm street, which is to be widened and extended on one end to the bridge and on the other to Lafayette place and Fourth avenue. The work, the *Record* says, is to be undertaken at once, and will be forwarded in the most expeditious manner, so that the trains may be running in the early summer of 1888. There will be four tracks; two for through and two for way travel.

The cultivation of beets for sugar is making rapid progress in Chili. In one of the largest factories for making the sugar the diffusion process is employed with such good results that the daily production is estimated by the *Mexican Financier* at 150,000 kilogrammes.

On Mount Whitney, the highest mountain in California, at a level of 14,000 feet above the sea and 1,500 feet above the timber line, where there is no soil and no moisture save snow and hail and ice, there grows a little flower shaped like a bell flower, gaudy in colors of red, purple, and blue. It is called Jacob's ladder, and its fragrance partakes of the white jasmine. It blooms alone, for it not only has no floral associates, but there is no creature, not even bird or insect, to keep it company.

It has been discovered how the wholesale milk poisoning occurred at Long Branch last summer. It has been conclusively shown for the first time, says *Health Monthly*, that milk warm from the cow, when placed in tight cans under conditions which greatly retard the dispersion of its heat, will undergo change, with the development, in the course of five hours, of a poison called tyrotoxicon. Fortunately, it is customary among milkmen to cool down before transportation, and now it appears that it is dangerous to deviate from this wise custom. Boiling milk dissipates even tyrotoxicon, and, as boiling also destroys the germs of acid fermentation, it is a good precaution for the summer time.

A writer in one of our medical journals says that it is considered by all physicians impossible to lay down any rules for health which may be followed safely by all persons. Health depends largely upon the diet. Some people cannot eat newly baked bread; others cannot eat it when stale. Much fresh meat with some constitutions induces fullness of the head and a feverish state of the system, because it makes blood too fast. It should therefore be discarded, and a little salt meat or fish, if the appetite craves it, with fresh fruit and vegetables, will be found probably to be just what the system requires. In truth, with health, as in many other things, each person must be a law unto himself.

Some months ago a number of persons went from Glasgow to Loch Fyne to see a large blasting operation, in which six and one-half tons of gunpowder were exploded. A short time after the explosion many of the observers became faint, six of the number died almost immediately, one died shortly after, and five others were very ill, but recovered. The editor of *Science* says the cause of death is believed to have been the carbonic oxide generated from the gunpowder. It is estimated that the amount must have been 468 pounds, a quantity sufficient to occupy 6,333 cubic feet of air space, or to vitiate for respiratory purposes a space one hundred times as great. There were also generated 3,575 pounds of carbonic anhydride; so that, in all, there were 1,266,000 cubic feet of air rendered irrespirable.

One who claims to have tried it, says that rubber may be fastened to iron by means of a paint composed of powdered shellac steeped in about ten times its weight of concentrated ammonia. It should be allowed to stand three or four weeks before being used.

This was the way a country blacksmith was seen removing that portion of an ax handle from the ax that remained in the eye, the break being close to the iron. The wood could not be driven out, and as nails had been driven in at the end, it could not be bored out. He drove the bit of sharp edge into some moist earth, and then built a fire around the projecting part. The wood was soon charred so that it was easily removed. The moist earth so protected the tempered part of the ax that it sustained no injury.

Mary E. Tousey, on the study of insects in the *American Teacher*, concludes that every insect has its use in the world. Many live very romantic lives—some are wanderers and some are social in their habits, all are wonderful. It is possible for us to discover the secrets of their lives and the mysteries of their homes, if we carefully study them.

The *Sanitary Enigneer*, in reply to an architect's inquiry, how to obtain the ivory finish used so much for producing the colonial wood work effect, says that from five to seven coats of oil paint are applied. With the last two Japan varnish and ivory white are mixed, so as to give the polish. Each coat of paint is rubbed down before the next is applied. With the last two coats, pumice stone is used for rubbing down. With cherry wood, five coats will do; with pine, seven are needed to get the same finish.

The American Exhibition in London has added to its attraction Buffalo Bill's Wild West show, which attracted such crowds at the Madison Square Garden, in this city, during the past winter. A correspondent writes that everything in the neighborhood of the exhibition is becoming Americanized. The shops are all labeled on the signs "The American Cigar Store," "The American Photographers," "The American Grocery," etc.

The public will be greatly benefited if the scheme under consideration by the Hon. A. W. McLelan, Postmaster-General, for creating a parcel post system between Canada and the United States. At present there is no system whereby parcels can be sent direct to their destination. Ignorance of postal laws has caused much inconvenience to the department, as well as to thousands of people, who are daily being notified that their respective packages have finally reached the Custom House.

The Relative Digestibility of the Chief Albuminoids.

Dr. James Fraser has made a series of experiments (*The Lancet*) to determine the digestibility of various proteids. The substances experimented upon were: Raw albumen, serum and egg; cooked albumen, also serum and egg; globulins, raw and cooked; myosin; derived albumen, viz., syntonin, alkali albumen, casein; vegetable albumen, impure gluten. Each of these was subjected to six hours' peptic digestion, then for six hours to pancreatic digestion. At the end of this time they were placed in a temperature of 176° F., and dialysis was allowed to proceed for twenty-four hours. The author gives the result of his researches in a tabulated form, and estimates the amount of peptones dialyzed as nitrogen. The most digestible albuminoid was found to be cooked myosin; then came raw serum albumen, after which the order was as follows: syntonin, alkali albumen, raw egg albumen, casein, cooked egg albumen, cooked serum albumen, raw myosin, and gluten. It might have been expected that syntonin would have headed the list, as it is partly digested beforehand, yet it was not far from being ahead of the others. These results apply to the albuminoids after they had gone through the processes of peptic and pancreatic digestion, as well as dialysis.

Each albuminoid substance was reduced to a dry solid state, and on taking the percentage relation between the amounts dialyzed and the amount of albuminoid actually used, it was found that in no case did fifty per cent of the dry solids pass through the dialyzer, this depending rather on the short period of dialysis than on imperfect peptonization, On examining the tables showing the amounts of nitrogen dialyzed in each stage of the experiment, it is seen that in no case did two per cent pass through the dialyzer during peptic digestion. The uncooked albumens gave the highest peptic results, and syntonin next. Turning to tryptic digestion, cooked myosin heads the list, then the order is as follows: Raw serum albumen, raw egg albumen, syntonin, cooked serum albumen, raw myosin, caseine, gluten, and cooked egg albumen last. This experiment being conducted in an alkaline menstruum, those substances which are most easily soluble in an alkaline solution have naturally an advantage in digestion. Hence the high position of raw albumens and of syntonin.

During the two stages of peptic and pancreatic digestion, peptones were formed more rapidly than they could pass away through the parchment paper, and accumulated in the dialyzers, so that when the ferment was killed by heating to 176° Fah., and dialysis was continued for twenty-four hours, a larger proportion of crystalloid matter passed through than in the former stages; these peptones were both of peptic and tryptic formations, as in the case of those under the head of pancreatic digestion. The largest proportionate result was found in the case of cooked myosin, which was not far ahead of raw serum albumen; then came cooked egg albumen, alkali albumen, caseine, cooked serum albumen, raw egg albumen, raw myosin, and lastly gluten. Many of these albuminoids are not ordinarily used as foods; for instance, serum albumen, raw myosin, syntonin, alkali albumen, though they are the most digestible of the albuminoids.

By utilizing the results of these experiments, much valuable aid can be given to those who require good, nutritious diet for invalids unable to digest solid food. Beef tea, as ordinarily prepared, is of little nutritive value; but if the white of an egg be mixed with a cup of beef tea and heated to about 160° F., the value of the beef tea is greatly enhanced. Again, if minced raw beef be just covered with very weak hydrochloric acid (four drops of acid to one pint of water) and left to macerate for the night, the liquid strained off and squeezed out of the flesh by wringing in a cloth contains so much syntonin as to make it highly nutritious when neutralized; such a liquid will remain clear after boiling to remove the raw flavor.

In cases where the digestive powers are not in abeyance, one may give by mouth or by enemata one or more of the various forms of peptonized foods or fluids that are now in the market. In cases where the digestive powers are lost in the stomach, but retained in the intestine, or where some obstruction to the passage of food into the stomach exists, the above experiments will give much help in treatment. The experiments with casein and gluten show that there are very few worse foods for a delicate stomach than the usual bread and milk; whey is a mildly nutritive fluid, and easily digested. In cases where it is desired to feed the patient through the intestine, those substances found soluble in alkaline fluids, and therefore easily acted on by the pancreatic juice, viz., raw albumen, syntonin, or alkali albumen, may be used alone or dissolved in some meat tea.

Oliver Hoyt.

One of the most respected and influential of the merchants and manufacturers in the leather industry of the country was Mr. Oliver Hoyt, of New York City, who died at his home in Stamford, Conn., May 5, from injuries received by a fall from his carriage two or three days previously. Mr. Hoyt was in his sixty-fourth year, and had been for more than forty years engaged in the leather business in New York. The firm of Hoyt Brothers, of which he was a member, was one of the largest manufacturers of sole leather in the world, there being only two or three other firms which approached them in the magnitude of their business. In 1882 we published an illustrated description of a new tannery then built by the firm in Pennsylvania. Mr. Hoyt served three terms as Senator in the Connecticut Legislature, and was an active member of the Methodist Episcopal Church, with whose educational and missionary enterprises he was prominently identified. He was a director in the National Park Bank and in the Home fire and Phœnix insurance companies of New York. He leaves a widow and four sons.

To keep postage stamps in the pocket or memorandum book without sticking, a New Orleans Post Office clerk advises people to rub the sticky side over the hair two or three times. The oil of the hair coats the mucilage and prevents it from sticking.

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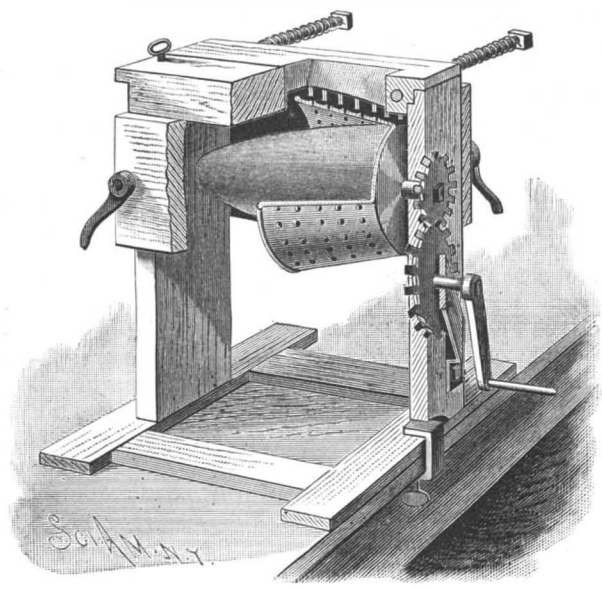
VEGETABLE GRATER.

The body of the grater is a box formed by uniting two vertical end strips by means of upper side strips. Within the box is mounted a shaft carrying a cone-shaped block, to the base of which is secured a grater consisting of a metallic cup-shaped attachment, having either outwardly flaring or cylindrical sides. In the grater are punched holes, the sharpened projections of which extend outward beyond the surface of the grater. To the tops of the vertical strips is secured a sectional cover, one section of which is rigidly connected to the strips, while the other rides upon extending arms and is held against the rigid section by springs, arranged as shown in the engraving. In the movable cover is an opening, and its under side is slightly cut away to accommodate the grater. One of the sections is provided with downwardly extending projections, that prevent



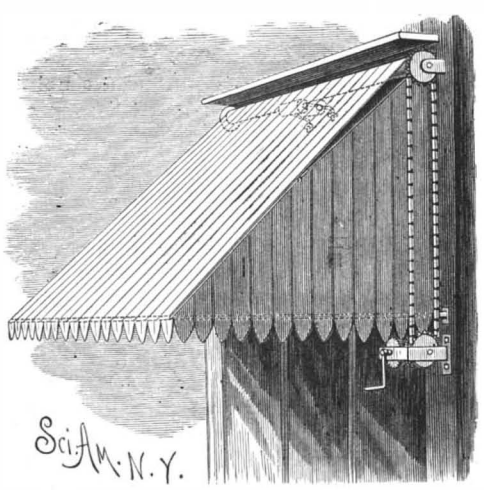
PLATNER'S VEGETABLE GRATER.

the entrance of material that would tend to clog the machine. The grater is driven by a crank shaft through suitable gearing. It may be clamped to a table or other support. It is rapid in operation, and can be easily cleaned.

This invention has been patented by Mr. M. D. Platner, of Virginia City, Montana.

DEVICE FOR OPERATING AWNINGS.

By means of the device here illustrated, the awning may be readily raised and lowered, and when raised it



CHARRON'S DEVICE FOR OPERATING AWNINGS.

is wound upon a suitable roller, and thereby protected from the weather and prevented from creasing. At each side of the window are attached horizontal brackets carrying a roller provided with a flange at one end and a sprocket wheel at the other. The upper edge of the front section of the awning is attached to the roller, and the lower edge is held to the transverse bar of a frame, whose side bars are pivoted to brackets secured to the building. The side pieces of the awning are held in engagement with the front, and the upper inclined edge of each side piece is provided with an elastic strip, so that the side pieces automatically gather or fold upon themselves as the awning is hoisted up. The transverse roller is guided by friction rollers held in bearings beneath and in engagement with, centrally, the roller. These friction rollers are detachably supported in a horizontal position by the entrance of their carrying frame in sockets attached to the wall above the window. For raising and lowering the awning, beveled gear wheels are journaled in an angular bracket secured to the side of the window frame near the sill. The shaft of one gear carries a sprocket wheel, around which and the sprocket wheel on the roller passes an endless chain. Each gear is provided with an integral post adapted to receive a key or crank. If found desirable, the outer gear may be dispensed with, as it is simply placed in connection with the inner gear for convenience. By turning these gears, it is evident that the awning may be easily and quickly raised and lowered.

This invention has been patented by Mr. Theophile Charron, of Kankakee, Ill.

IMPROVED HARROW AND PULVERIZER.

The harrow is provided with vertical stationary teeth, between which are arranged revolving wheels, having teeth adapted to pierce clods and pieces of sod. The sides of the triangular frame are made in sections, whose ends are bent at an obtuse angle in opposite directions, to adapt them for attachment to frames in which the wheels revolve. The sides of the main frame are furnished with vertical teeth in the usual way. The teeth of the wheel are made longer than the others, and the bearings of the wheels are placed on the upper side of the frame. As the harrow advances, the greater length of the wheel teeth enables them to pierce clods before the latter come in contact with the two vertical teeth located on either side of the wheels. The radius of the wheels being greater than the length of the vertical teeth, the wheels revolve slowly, so that the clods are practically held nearly stationary while the contiguous vertical teeth advance. The latter thus come in contact with the clods on each side and tear and pulverize them as the revolving teeth pass slowly backward between them. Another reason for placing the bearings of the wheels above the frame is to make the draught of the harrow lighter than it would be if the wheels were smaller. In order to prevent the harrow from operating on the surface of the ground when being drawn to and from the field, each wheel is provided with a protector, consisting of a flexible detachable tire having a series of funnel-shaped pockets, one for each tooth, attached to its inner side. When this protector is applied to the wheels, they serve as ordinary supporting and transporting wheels. The wheels are provided with a limiting flange, which is a ring formed in sections, one for each tooth, which are perforated midway between their ends for the passage of the teeth, the ends being united by bolts and nuts.

This invention has been patented by Mr. Samuel Rothchild, of Pendleton, Oregon.

Musk Scented Gnats.

To the list of sources of musk must be added a kind of gnat, order Hemiptera, class Reduvidæ, genus Amulius (*Stol.*), which is so common in the bush at times as to fill the air with a musky odor. The source of the odor has hitherto been an enigma, but has at last been traced by Mr. A. Alder, of Caloundra, Queensland, and the insects classed by Mr. Tryon, of the Brisbane Museum.

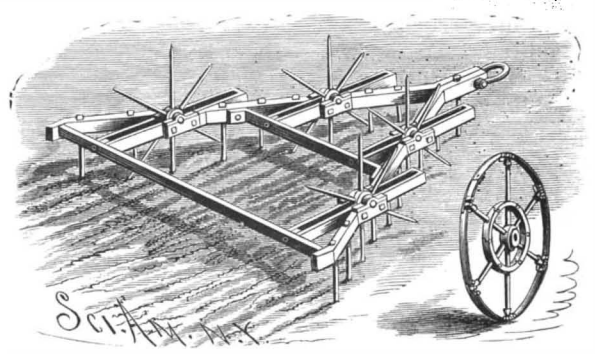
IMPROVED HORIZONTAL STATIONARY ENGINE.

The engine here illustrated is designed especially for driving dynamos for electric lighting and for other uses requiring smooth and steady power, and is better on that account for general power purposes, and is cheaper per horse power than ordinary engines in first cost. All the parts of the engine are well proportioned, the bearings are large and amply provided with lubricating apparatus, and the workmanship and material entering into its construction are excellent. The engine is so designed as to obtain more effective power from a given amount of fuel in proportion to first cost than any engine heretofore introduced. Opportunities for observation of the practical working of the details of the engine have been offered by long practical tests in every day work. These have given good satisfaction, while the engines now in use in various works have proved to be strong, durable, and economical in fuel and repairs.

This engine was designed and is manufactured by the Pennsylvania Diamond Drill Co., of Birdsboro, Pa., to whom all communications should be addressed.

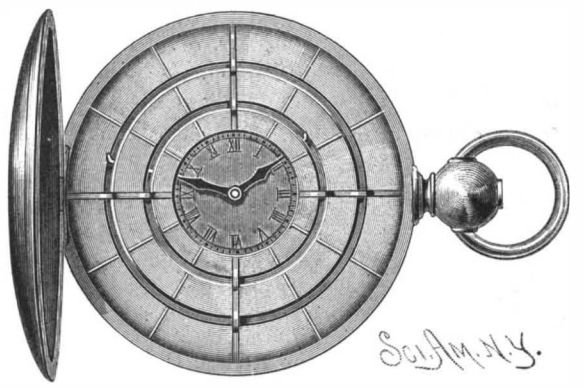
WATCH FOR THE BLIND.

This watch is so constructed that the time may be told in the dark or by the blind. The works of the watch are covered below the hands by a plate, on which is formed a small dial. Each hand is formed with a knob or projection at its end, and over the hands is placed a concave disk, composed of several concentric annular rings spaced to form annular slots, in which the upwardly projecting knobs of the hands move, so



ROTHCHILD'S IMPROVED HARROW AND PULVERIZER.

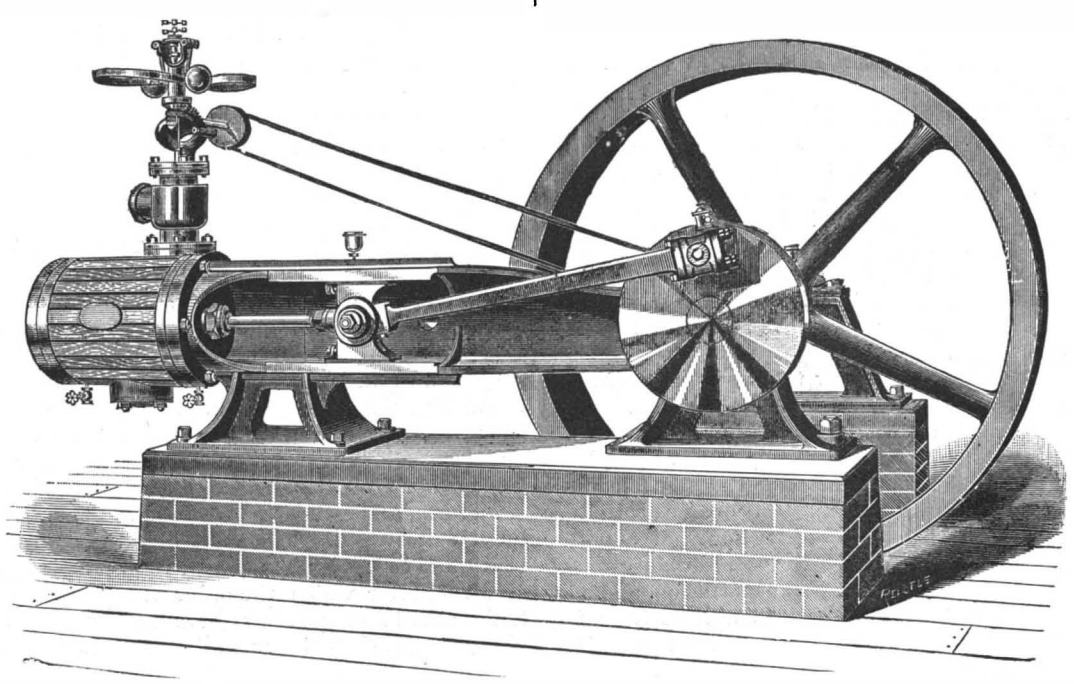
that they can be felt by the finger through the slots, and their relative position on the dial determined by the sense of touch. The annular plates are united by four radial ribs, formed with upwardly curved bridge pieces to span the slots, so as not to interfere with the movement of the hands. Upon the outer surfaces of the plates are ribs, so that, in all, there are twelve ribs arranged at equal distances apart and marking the hours and five-minute divisions. The face of the watch is closed by a cover, which is a small crystal, through which the dial may be observed. To ascertain the time by the sense of feeling, the fingers are moved around the slots to find the knobs, when their location with reference to each other and to the XII. side of the dial will be found by counting the ribs, which can be easily done, so that with a little practice the hour and minute can be accurately told by this watch in the dark or by a blind person.



ADAM'S WATCH FOR THE BLIND.

This invention has been patented by Mr. Samuel F. Adam, of Middletown, Conn.

THE *American Agriculturist* presents to its readers, on a sheet 12×19 in., a beautifully executed picture of the late Henry Ward Beecher. It is made directly from a negative taken by a well-known portrait artist after Mr. Beecher's latest return from Europe, and brings out all the details with a fidelity such as is attained only in this way of making pictures. The distinguished preacher and orator was always a hard worker, and this picture, among the latest of the many that were taken of him, indicates that his force and power remained substantially undiminished to the last.



IMPROVED HORIZONTAL STATIONARY ENGINE.

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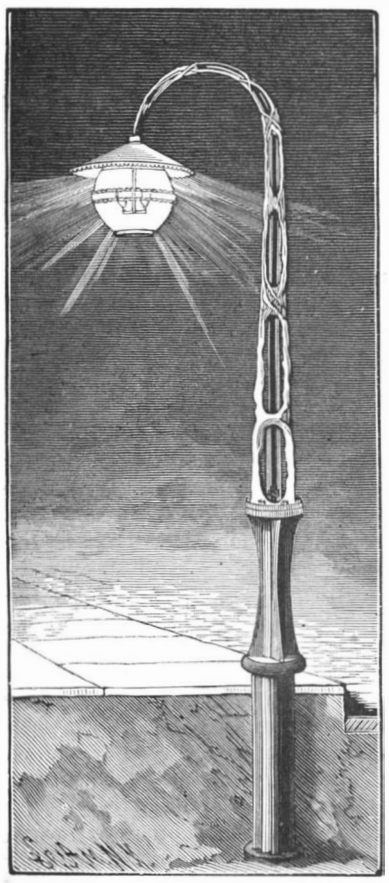
IMPROVED LAMP POST.

This lamp post is designed principally for street lighting purposes in cities and towns. It is composed of two sections, the upper end of the lower one of which is formed with a flange fitting in an inverted cup-shaped flange on the upper section, the two being held together by bolts passed through the flanges. The lower length extends partly into the ground, and is of cylindrical form, with ribs cast on its exterior to give strength and shape. The upper part is cylindrical, and formed with transverse openings, and is artistically ornamented. The upper end bends in the form of a half or part circle, in order that the attached gas lamp may hang over the center of the side walk, out of line or interference with telegraph or other poles, shade trees, or other obstructions. The lower section forms a capacious gas chamber, connected with the top of which is a pipe leading through the upper section to the gas jet. The lower end of this pipe is provided with a stop cock. By this construction there will be no freezing or choking of the gas, on account of the large volume of gas contained in the chamber, and as the gas when not being used is turned off from the upper section of the post. When the gas is burning, the current established will keep the gas in the pipe from stopping or freezing. The gas is thus prevented from stopping or freezing, both when turned on and off. By the downward bend given to the post and pipe at the top, the pipe is extended to pass over the flame down through the lamp, thereby causing the gas to be highly heated and materially increasing its illuminating power. The position of the stop cock is such that a ladder is not necessary in order to light or extinguish the gas. The upper length of the post may be made more ornamental than usual and cheaper, as all expensive core work in its construction is avoided.



This invention has been patented by Mr. Martin N. Diall, of Terre Haute, Indiana.

FOLDING AND PASTING MACHINES.

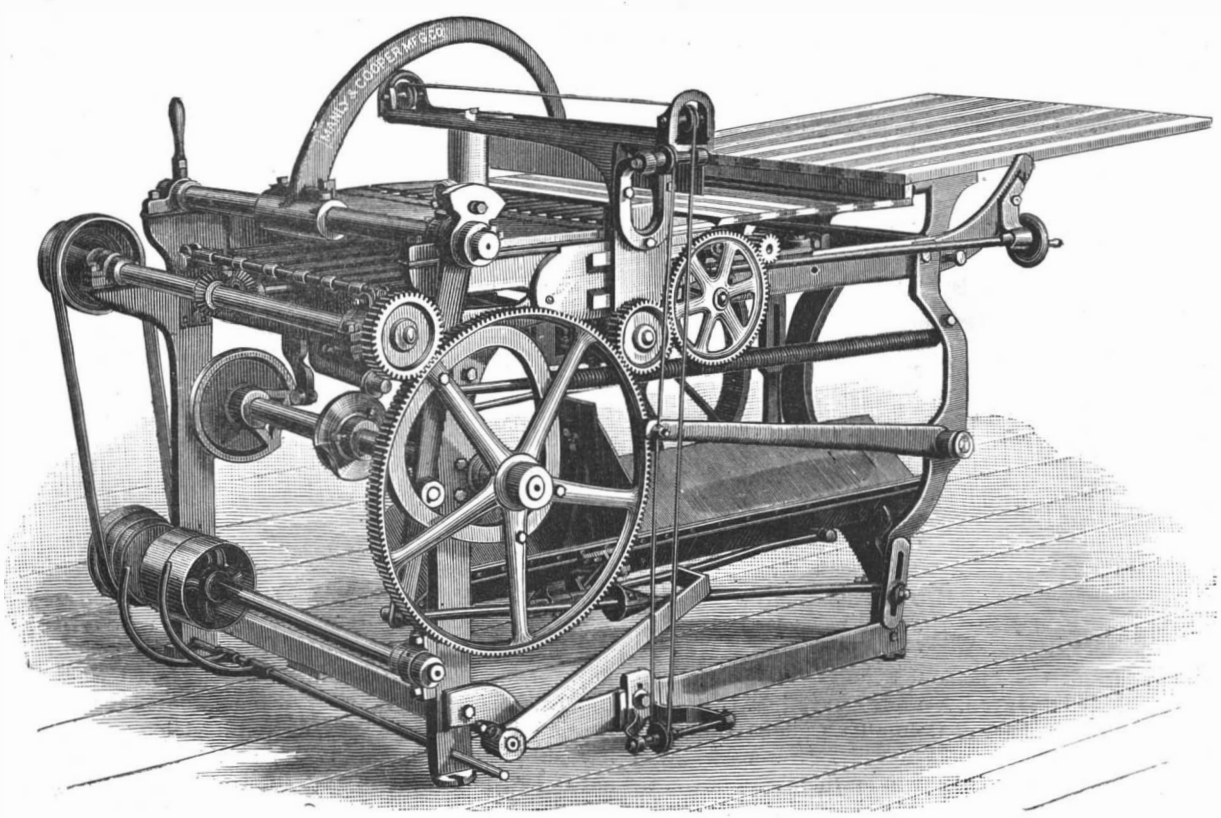
After a long series of experiments, the Manly & Cooper Manufacturing Company, of Philadelphia, Pa., has perfected a practical and efficient paster and folder, an announcement which we are sure will be a most welcome one to all whose business it is to bind books and pamphlets. This machine is not offered as an experiment, but after practical use by manufacturers. It not only folds the sheets, but does the pasting before the sheet leaves the table, and in such way that the operator sees that every sheet is thoroughly pasted before it is folded. The great value of this feature is readily understood by all who have been embarrassed by the negligence and carelessness of workpeople or by the poor performance of their machines, when the putting on of too much or too little paste, or its uneven distribution, have heretofore been frequent cause of complaint against machine folding in all first-class work. Only one paste cup is used, and the trouble of a fountain is saved, while the simplicity of the mechanism secures high speed and ready adjustment.

The machine can be used with or without the paster, and it can be furnished without the pasting attachment, to be used as a book or pamphlet folder only. It folds either to register or to margin, making one, two, three, or four folds, thus producing sections of four, eight, sixteen, or thirty-two pages, and with greater accuracy than if done by hand, and the cost is reduced about five-sixths. The floor space occupied by the machine is small, and its capacity is from 1,200 to 1,600 sheets an hour from a 16 page folder with one operator, or 1,000 to 1,500 sheets for a 32 page folder.

Simplicity of mechanism is a great desideratum, and it has been the aim of the manufacturers to simplify construction, so that any one can readily understand and adjust any part of the machine. The ease of adjustment and the attachment of a micrometer scale allow the machine to be changed without delay, and give an exactness of execution which is unequaled.

In addition to a paster, the folding machine is fitted with a coverer when desired, by which the covers are put on pamphlets before they leave the machine, and another handling is thus saved.

A reference to the cut shows the action. The sheet, laid flat on the table and held in place by the points or margin guides, is struck by a knife on the curved arm and carried through the slit to be taken by tapes along to a knife at right angles to the first knife. Here the second blow is given, and the sheet, folded in two pages by the first knife, is now folded in four pages by the second knife, and caught by the tapes and carried back on a lower level, each cutting doubling the number of pages until the required fold is made, when the folded sheet is placed with its fellows in the trough and is ready to bind, or if the pasting and covering attachment has been used, it is ready for distribution to the book stalls.



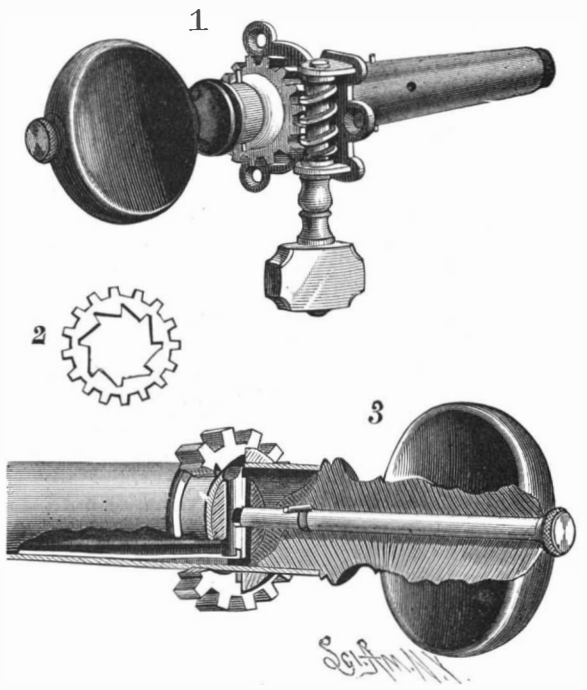
FOLDING AND PASTING MACHINE.

CLEARING ATTACHMENT FOR GRAIN DRILLS.

The object of this attachment is to free the shoes of drills from trash and grass, which greatly impede the progress of the drill when it is used for sowing grain upon land abounding in stalks, or what is known as "crab grass." In ordinary drills four or more hinged carrying arms and attached shoes are arranged at equal distances upon each side of the pole. In this improvement each shoe is provided with a clearing attachment. Upon the upper face of the forward beam of the frame of the drill are secured standards that form bearings for two longitudinal levers having central angular arms projecting outward, and by means of which the levers may be conveniently operated by the driver with his feet. The outer ends of horizontal twisted arms, one for each shoe, are fastened to the levers and their inner ends are pivotally attached to a connecting bar, consisting of one or two bars, made to extend at an inclination forward to a point near the front beam of the frame, and to a pivotal connection with a clearing bar. The clearing bars are fulcrumed upon pins of adjustable plates bolted to the carrying bars, which are preferably formed of two thin bars. The free end of each clearing bar is bent downward and formed with an upward curve, in order to permit it to pass readily over obstructions and prevent entanglement with the grass. When, in the use of a drill provided with this attachment, the shoes become clogged by grass or other refuse, the driver presses upon either or both of the angular arms or treadles of the levers with his feet, and thereby causes the shoes to rise from the ground, the clearing bars being simultaneously pressed upon the obstruction and clearing the shoes. When the levers are released, the shoes will drop to the ground of their own weight, and the clearing bars will be returned to their normal position, a little above the ground. A spring may, if thought desirable, be arranged to assist in the return of the clearing bars.

MITCHELL'S CLEARING ATTACHMENT FOR GRAIN DRILLS.

This improvement, which is the invention of Mr. William H. Mitchell, of Horse Cave, Ky., may be attached to any hoe drill.



GARDNER'S VIOLIN TUNING PEG.

[FOR DESCRIPTION SEE PAGE 309.]

A GIGANTIC GAS WELL.—The largest gas well in the world has just been discovered at Fairmount, Indiana. The test of Professor Orton, State Geologist of Ohio, shows that it is flowing nearly twelve million cubic feet per day.

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The National Academy of Sciences—A Historical Sketch.

BY MARCUS BENJAMIN.

Soon after the beginning of the civil war, numerous questions of importance, requiring a scientific solution, came before the national government. A new explosive was submitted to the War Department, a new monitor to the Navy Department, and, indeed, from all directions came suggestions, many of which demanded an official investigation. The scientific experts of the government, prominent among whom were Alexander Dallas Bache, superintendent of the Coast Survey, and Joseph Henry, secretary of the Smithsonian Institution, were in frequent consultation with the leading heads of the departments.

Recognizing the advantage to be derived from the active co-operation of men of science, many of whom, being specialists, could readily furnish desired information at once, the idea of a national academy of sciences, like the Royal Society of England and the Academy of Sciences of France, was urged upon the government.

The duties of this new body were to include, whenever called upon by any department of the government, the investigation, examination, experimenting, and report upon any subject of science or art, the actual expenses of such work and report to be paid from appropriations which may be made for the purpose; but the academy was to receive no compensation whatever for any services rendered to the United States government. Its membership was to consist of not more than fifty ordinary members, who must be citizens of the United States. Subsequently, the limitation to membership was removed, and it was decided to admit fifty foreign associates.

An act was passed through Congress on March 3, 1863, incorporating the National Academy of Sciences, and the first meeting was held in New York, beginning on the 22d of April, 1863. Superintendent Bache was chosen president, and an organization effected by the adoption of a constitution. Among the important provisions of the latter was that the academy shall hold one stated session in each year in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council may direct. The later, called the scientific session, was at first called during August, but is now convened in November, has been held in New Haven, Conn.; Northampton, Mass.; Hartford, Conn.; Cambridge, Mass.; New York, N. Y.; Philadelphia, Pa.; Newport, R. I.; and Albany, N. Y. The constitution gives power to the presiding officer to appoint all committees, among which are those "On Ways and Means to provide a Fund for the Academy," "On Weights, Measures, and Coinage," "On the Election of Foreign Associates," "To Co-operate with the National Board of Health," "On Publications of the Academy," and "On the Relation of the Academy to the Government;" and also to refer investigations required by the government of the United States to members speeially conversant with the subjects, with request to report thereon to the academy at its session next ensuing. Among such committees of recent standing are those "On Reserving Public Lands on and near Mount Whitney, California, for Scientific Purposes," "On Questions of Meteorological Science and its Applications," "To Report on the Triangulation to Connect the Atlantic and Pacific Coasts," "On the Investigation of Glucose for the Department of Internal Revenue," "On the Total Eclipse of 6th of May, 1883," "On the Organization of National Surveys and Signal Service," and "On Customs Duty on Philosophical and Scientific Apparatus." Many of these committees remain in force for years, or until the purpose for which they were appointed has been accomplished.

Any attempt to review the work performed by the academy is naturally out of the question, but as an illustration of how it is executed a brief description of its action in reference to the "customs duty on philosophical and scientific apparatus" may be made. The Secretary of the Treasury, finding that great difficulty was experienced by appraisers in customs in determining what instruments and other articles were entitled to classification for duty as "philosophical apparatus and instruments," referred the matter to the academy, with a request that a list be reported comprising the different articles which properly come within the scope of such title. A committee, consisting of Prof. George J. Brush, of Yale College; Prof. Wolcott Gibbs, of Harvard University; Dr. Samuel H. Scudder, of Cambridge, Mass.; Prof. Simon Newcomb, of the "United States Nautical Almanac" office, Washington, D. C.; and Prof. George F. Barker, of the University of Pennsylvania, reported that, "First, an instrument is philosophical, not in consequence of its special construction or function, but in consequence of the uses to which it is to be put, and many instruments may be put both to uses which are philosophical and to uses which are purely industrial or commercial. Secondly, the number of different kinds of philosophical apparatus is so great, and new kinds are so constantly added, that an exhaustive enumeration is impracticable." This statement was duly transmitted to the Secretary of Treasury by the president of the academy.

The academy has received by bequest the property of Alexander D. Bache, in trust, the income to be devoted to the prosecution of research in physical and natural science by assisting experimentalists and observers, and the publication of the results of their investigations. From this fund there is derived an annual income of $4,500, which is devoted to a magnetic survey of the United States, under the direction of a committee of the academy. On the death of Joseph Henry, in 1878, a sum of $40,000 was left to the academy, concerning the disposition of which nothing has as yet been done. In 1880, there was received from the estate of James C. Watson an amount equivalent to nearly $14,000, from the interest of which a medal is to be prepared to be awarded to the person in any country who shall make any astronomical discovery or produce any astronomical work worthy of special reward and contributing to the progress of astronomy. Two years later, on the death of Henry Draper, his widow presented to the academy $6,000 for the establishment of a gold medal, to be awarded every two years to the individual, in this or any country, who makes the most important discovery in astronomical physics, the value of the medal to be $200. The sum of $8,000 was placed at the disposal of the academy by the widow of J. Lawrence Smith, as a memorial fund to promote the study of meteoric bodies.

It is customary among the members of the academy to read papers at their meetings descriptive of some investigation or discovery with which they have been engaged during the year. A notice of such a communication must first be given to the secretary, and the academy does not hold itself responsible for the facts or opinions expressed by the author, but considers itself responsible only for the propriety of the paper. In the annual report of 1883, a list of the titles of 777 papers is given, which have been read at meetings. This number was increased by forty-nine in 1884, and by forty-four in 1885, and by fifty in 1886; we have a grand total of 920, or very nearly 1,000 papers presented to the academy since 1864. This list includes not only memoirs by members of the academy, but also papers on the researches of other scientists, who have been invited to attend the sessions.

The publications of the academy are of three kinds —annual reports, memoirs, and biographical memoirs. Of these the first are transmitted each year to the president of the senate, and are published as octavo pamphlets containing the proceedings of the meeting held, list of papers read, and an appendix giving the special reports of the committees appointed to consider subjects referred to the academy by the departments. The memoirs are a series of quarto volumes containing valuable contributions to science, made by the members, and originally presented to the academy in the form of papers, read at its sessions. Two complete volumes and part of a third have already been issued.

The officers are chosen for a term of six years, and the first president, as has been stated, was Alexander D. Bache. He was succeeded on his death, in 1868, by Joseph Henry, who then held office until 1878. William B. Rogers followed, and on his death, Othniel C. Marsh became president. The present officers are, besides Prof. Marsh as president, Simon Newcomb, vice-president; Wolcott Gibbs, foreign secretary; Asaph Hall, home, and John H. C. Coffin, treasurer.

The membership of the academy now includes some ninety-eight scientists. A full list is herewith given, which is taken from the official register of June, 1886. Cleveland Abbe, meteorologist at the U. S. Signal Service Office, Washington, D. C.; Gen. Henry L. Abbot, of the topographical engineers, in command of the station and school at Willet's Point, N. Y.; Alexander Agassiz, naturalist, and considered the best authority in the world on certain forms of marine life; J. Asaph Allen, curator of animals and birds at the American Museum of Natural History, New York; Spencer F. Baird, naturalist, and secretary of the Smithsonian Institution, Washington, D. C.; George F. Barker, professor of physics at the University of Pennsylvania, Philadelphia, Pa.; Frederick A. P. Barnard, president of Columbia College, New York; Col. William H. C. Bartlett, professor of natural sciences and experimental philosophy at the U. S. Military Academy until 1871, since when he has lived in retirement at Yonkers, N. Y.; Alexander Graham Bell, inventor of the telephone, Washington, D. C.; Dr. John S. Billings, compiler of the "Index Catalogue of the Surgeon-General's Office," Washington, D. C.; William H. Brewer, agricultural chemist, and Norton professor at the Sheffield Scientific School, New Haven, Conn.; William K. Brooks, naturalist, and professor of morphology at the Johns Hopkins University, Baltimore, Md.; Dr. Charles E. Brown-Sequard, physiologist, and professor of experimental medicine in the College of France, Paris; George J. Brush, mineralogist, and director of the Sheffield Scientific School of Yale University, New Haven, Conn.; Charles F. Chandler, professor of chemistry at Columbia College and dean of the faculty at the School of Mines, New York; John H. C. Coffin, senior professor of mathematics of the U. S. Navy, on the retired list, and formerly in charge of the "American Ephemeris and Nautical Almanac," Washington, D. C.; Gen. Cyrus B. Comstock, of the engineer corps, and superintendent of the geodetic survey of the northern and northwestern lakes, New York; Josiah P. Cooke, professor of chemistry at Harvard University, Cambridge, Mass.; Edward D. Cope, naturalist and paleontologist, connected with the U. S. geological survey, Philadelphia, Pa.; Elliott Coues, naturalist and professor of biology in the Virginia Agricultural and Mechanical College, Washington, D. C.; James M. Crafts, chemist, and formerly professor at the Massachusetts Institute of Technology, Boston, Mass.; Dr. John C. Dalton, physiologist and president of the College of Physicians and Surgeons, New York; Edward S. Dana, mineralogist and assistant professor of natural philosophy and astronomy at Yale University, New Haven, Conn.; James D. Dana, mineralogist and Silliman professor of mineralogy and geology at Yale University, New Haven, Conn.; George Davidson, assistant on the U. S. Coast Survey, and in charge of Davidson Observatory, San Francisco, Cal.; Capt. Clarence E. Dutton, connected with the U. S. Geological Survey, Washington, D. C.; James B. Eads, civil engineer and builder of St. Louis Bridge; William G. Farlow, professor of cryptogamic botany at Harvard University, Cambridge, Mass.; William Ferrel, meteorologist and late connected with U. S. Signal Service, Kansas City, Mo.; Frederick A. Genth, chemist and professor of chemistry and mineralogy at the University of Pennsylvania, Philadelphia, Pa.; Josiah W. Gibbs, physicist and professor of molecular physics at Yale University, New Haven, Conn.; Wolcott Gibbs, chemist and Rumford professor of the application of the useful arts to life at the Lawrence Scientific School of Harvard University, Cambridge, Mass.; Grove K. Gilbert, geologist of the U. S. Geological Survey, Washington, D. C.; Theodore N. Gill, ichthyologist and connected with the Smithsonian Institution, Washington, D. C.; Benjamin A. Gould, astronomer and late director of the Cordova Observatory, Argentine Republic, Cambridge, Mass.; Asa Gray, the Nestor of American botanists, and professor of botany at Harvard University, Cambridge, Mass.; Arnold Hague, geologist, in charge of the Yellowstone division of the U. S. Geological Survey, Washington, D. C.; Asaph Hall, astronomer at the U. S. Naval Observatory and discoverer of the moons of Mars, Washington, D. C.; James Hall, paleontologist and director of the New York State Geological Survey, Albany, N. Y.; Ferdinand V. Hayden, late geologist of the Montana division of the U. S. Geological Survey, Philadelphia, Pa.; Eugene W. Hilgard, professor of agricultural chemistry at the University of California, Oakland, California; Julius E. Hilgard, late superintendent of the United States Coast Survey, Washington, D. C.; George W. Hill, astronomer and assistant at the office of the "Nautical Almanac," Washington, D. C.; Edward S. Holden, astronomer and president of the University of California, also director of the Lick Observatory, Berkeley, California; T. Sterry Hunt, scientist and president of the Royal Society of Canada, Montreal, Canada; Alpheus Hyatt, naturalist and curator Boston Society of Natural Science, Boston, Mass.; Charles L. Jackson, Cambridge, Mass., professor of organic chemistry at Harvard University; Samuel W. Johnson, chemist and director of the Connecticut State Board of Agriculture, also professor of theoretical and agricultural chemistry at Yale University, New Haven, Conn.; Clarence King, geologist and late in charge of the United States Geological Exploration of the 40° parallel in New York; Samuel P. Langley, astronomer and assistant secretary of the Smithsonian Institution, Washington, D. C.; Joseph Leidy, naturalist and professor of anatomy at the University of Pennsylvania, Philadelphia, Pa.; J. Peter Lesley, geologist and chief of the Geological Survey of Pennsylvania, Philadelphia, Pa.; John Le Conte, physicist and professor of physics and industrial mechanics in the University of California, Berkeley, Cal.; Joseph Le Conte, geologist and professor of geology and natural history in the University of California, Berkeley, Cal.; Leo Lesquereux, makes a specialty of fossil botany, and his work appears in the reports of United States and State Geological Survey reports, Columbus, O.; Miers F. Longstreth, Derby, Pa.; Elias Loomis, mathematician and professor of natural philosophy and astronomy at Yale University, New Haven, Conn.; Joseph Lovering, physicist and professor at Harvard University, Cambridge, Mass.; Theodore Lyman, naturalist and commissioner of inland fisheries of Massachusetts, Cambridge Mass.; Othniel C. Marsh, paleontologist and curator of the Peabody Museum of Yale University, New Haven, Conn.; Alfred M. Mayer, professor of physics at the Stevens Institute of Technology, Hoboken, N. J.; General Montgomery C. Meigs, of the United States Engineers, now retired, Washington, D. C.; Henry Mitchell, in charge of the Eastern division of the United States Coast Survey, Boston, Mass.; Dr. S. Weir Mitchell, noted for his researches in serpent poisons, nerve physiology, and similar subjects, Philadelphia, Pa.; Edward S. Morse, naturalist, late professor at the University of Tokio, Japan, Salem, Mass.; Henry Morton, physicist and president of the Stevens Institute of Technology,

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Hoboken, N. J.; John S. Newberry, professor of geology and paleontology at the Columbia College School of Mines, and late State geologist of Ohio, New York; Simon Newcomb, astronomer and superintendent of "Nautical Almanac," Washington, D. C.; Hubert A. Newton, mathematician and professor of mathematics at Yale University, New Haven, Conn.; General John Newton, late chief of the corps of engineers, U. S. army, and commissioner of public works, New York; James E. Oliver, professor of mathematics at Cornell University, Ithaca, N. Y.; Alpheus S. Packard, naturalist and professor of natural history at Brown University, Providence R. I.; Charles S. Pierce, late assistant and acting superintendent, United States Coast Survey, Washington, D. C.; Charles H. F. Peters, astronomer and director of the Litchfield Observatory, Clinton, N. Y.; Edward C. Pickering, astronomer and director of the Harvard Observatory, Cambridge, Mass.; Raphael Pumpelly, geologist, and has had charge of the Missouri State geological survey, and the transcontinental survey of the Northern Pacific Railway, Newport, R. I.; Frederick W. Putnam, ethnologist and curator of the Peabody Museum, Cambridge, Mass.; Ira Remsen, professor of chemistry at the Johns Hopkins University, Baltimore, Md.; Fairman Rogers, engineer, and formerly lecturer on mechanics at Franklin Institute, and professor of civil engineering at the University of Pennsylvania, Philadelphia, Pa.; William A. Rogers, Cambridge, Mass.; Ogden N. Rood, physicist and professor of physics at Columbia College, New York; Henry A. Rowland, professor of physics at the Johns Hopkins University, Baltimore, Md.; Lewis M. Rutherfurd, astronomer, New York; Charles A. Schott, connected with the United States Coast Survey, Washington, D. C.; Samuel H. Scudder, naturalist, and late editor of *Science*, Cambridge, Mass.; William Sellers, mining engineer, Philadelphia, Pa.; Sidney I. Smith, professor of comparative anatomy at Yale University, New Haven, Conn.; John Trowbridge, professor of physics at the Lawrence Scientific School of Harvard University, Cambridge, Mass.; William P. Trowbridge, professor of engineering at the Columbia College School of Mines, New York, N. Y.; James H. Trumbull, philologist and superintendent of the Watkinson Library, Hartford, Conn.; Addison E. Verrill, naturalist and professor of zoology at Yale University, New Haven, Conn.; Francis A. Walker, statistician, late superintendent of the census, and president of the Massachusetts Institute of Technology, Boston, Mass.; Dr. Horatio C. Wood, professor of materia medica, pharmacy, and general therapeutics, and clinical professor of nervous diseases of the University of Pennsylvania, Philadelphia, Pa.; A. H. Worthen, geologist, and in charge of the State Survey of Illinois, Springfield, Ill.; Arthur W. Wright, physicist and professor of molecular physics and chemistry at Yale University, New Haven, Conn.; Charles A. Young, astronomer and professor of that branch at the College of New Jersey, Princeton, N. J.

The foreign associates, limited to fifty members, include: John C. Adams, astronomer, discoverer of Neptune, Cambridge, England; Sir George B. Airy, astronomer royal of England, Greenwich, England; Arthur Auwers, astronomer, Berlin, Germany; Joseph L. F. Bertrand, mathematician, Paris, France; Pierre E. M. Bertholet, chemist, Paris, France; Jean B. J. D. Boussingault, chemist, Paris, France; Robert W. Bunsen, chemist, Heidelberg, Germany; Hermann Burmeister, naturalist, Buenos Ayres, S. A.; Arthur Cayley, mathematician, Cambridge, England; Michel E. Chevreul, chemist, Paris, France; Rudolph Clausius, physicist, Bonn, Germany; Alphonse De Candolle, botanist, Geneva, Switzerland; Baron Hermann v. Helmholtz, physicist, Berlin, Germany; Thomas H. Huxley, naturalist, London, England; Sir Joseph D. Hooker, botanist, Kew, England; Gustav R. Kirchhoff, physicist, Berlin, Germany; Rudolf Albert von Kolliker, physiologist, Wurzburg, Germany; Theodore von Oppolzer, astronomer, Vienna, Austria; Richard Owen, anatomist, London, England; Louis Pasteur, chemist, Paris, France; Ferdinand v. Richthofen, geologist, Berlin, Germany; George G. Stokes, mathematician, Cambridge, England; Otto N. von Struve, astronomer, St. Petersburg, Russia; James J. Sylvester, mathematician, Oxford, England; Sir William Thomson, Glasgow, Scotland; Rudolph von Virchow, anatomist, Berlin, Germany.

Relative Cost of Water and Steam Power.

A subscriber at Portland, Ore., writes to the *Lumber Trade Journal*, and wants to know "whether it is cheaper to run a saw mill by water or steam power." He further says: "I am about to engage in a large enterprise at a point in Washington Territory where there is abundant water power, but sometimes the river falls low, and is not available for a steady manufacturing business. Had I better rely upon steam power or water power; which, in the end, is the cheapest?"

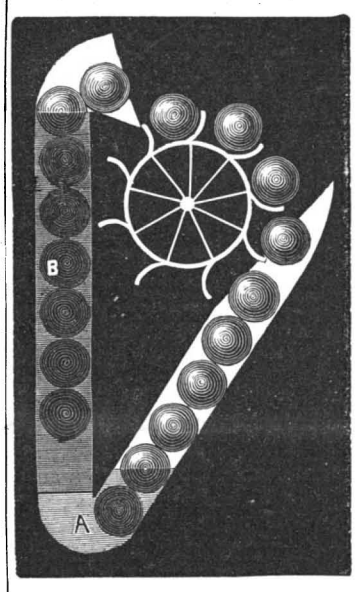
In reply, the editor says that the water equipment at Lowell, Mass., was for canals and dams $100, and for wheels, etc., another $100 per horse power. But this as a first experiment was more costly than a similar experiment need be. At Saco, Me., the expense incurred was $165 per horse power; but at a later period, for turbines with high heads, the expense would be less. A construction and equipment, solidly carried out, with the latest improvement in wheels, would not cost over $200 per horse power (probably less) under favorable circumstances. If we remember correctly, an estimate at Penobscot, Me., was for $112.50 per horse power. If the construction be with wooden dams, and the equipment with lower grade wheels, then the cost would be less than $50 per horse power; and although the construction would be less permanent than the more solid, it would outlast any steam apparatus. On the other hand, Fall River (Mass.) estimates of steam equipment, exclusive of foundations and engine houses, run from $100 to $115 per horse power. A Boston authority gives $110 for nominal 300 horse power and upward, inclusive of foundations and masonry. Similarly a Portland (Me) authority places it at $100 per horse power for nominal 300 horse power.

A PERPETUAL MOTION MACHINE—WILL IT WORK?

I herewith send you my thoughts on a perpetual motion arrangement that I have never noticed in print. It is very simple, and I would very much like to see it illustrated and commented upon by you.

I use a tubular tank, in which the balls to be used just fit. The power wheel is arranged to catch these balls, and the turning of the wheel by the weight of the balls is the power produced.

The tube is filled one side with water and the other side with enough mercury to force the water up to the top of column. In the figure, A is mercury, and B the water. The balls to be used are made of iron, with an air tight chamber filled with gas to make them float in water.



The machine is supposed to operate in this way: The balls are started on mercury side. Several will be needed to force the first ball through the mercury, but the moment it has passed the center it will rise to the top of column of water. The next coming balls will force it out until it rolls off on to the proper place on the power wheel. Here the balls exert their weight, turn the wheel, and then drop back into starting channel to force the ones ahead of it through the mercury back into the water again.

If each ball weighs say ten pounds, it seems as if there would be enough weight to force it through the mercury into the water, and then it would at once rise up higher than from where it started.

The difference of power seems to be the *weight* of the ball on one side and the *buoyancy* of the same ball on the other, *but I am afraid that the mercury is so dense that the amount of weight needed to force the first ball through the mercury will just balance the weight of the column of water.* If we take two tubes, partly fill the one with water, and the other partly fill with just enough mercury to balance each other. Now, if we take iron balls that will float, and place the balls one over the other in each tube, which one will require the greatest number of balls to force the first ball to the bottom? Can this be determined by science, or must it be found out by experiment?

New Albany, Ind. HENRY A. GOETZ.

[The writer of the above communication outlines pretty clearly the fallacy. With regard to the question at the end of the letter, we reply: The same number of balls will be required to force the first ball to the bottom, whether through mercury on one side or through mercury and water on the other side. The amount of weight required to force the first ball through the mercury will just balance the increased pressure due to displacement of the water or additional raising of the height of its column.—ED.]

Telegraph Wires in New Orleans.

The city of New Orleans is about to adopt a system of Colonel Flad for overhead wires. This consists in erecting tall towers at the street corners, which will carry the wires over the roofs. The system will be under the supervision of the Commissioner of Public Works, and the older method of running the wires, telegraphic, telephonic, and electric lighting, on poles will be abolished. The towers will be classified for the different classes of wire; and the wires are not to be less than 10 ft. above the roofs. The Star Iron Tower Company, of Fort Wayne, has received an order for 224 towers.

Correspondence.

Casting Steel Ships.

To the Editor of the Scientific American:

Being greatly interested in our coast defenses, I would like to make a suggestion, after reading Sir Henry Bessemer's proposal to cast *in situ* the whole face of a fort. Why not cast the hulls of our new war vessels? There are no insurmountable obstacles in the way, and the plant once established could be used for a hundred or more vessels, which, when cast, could be cleared and floated away to be finished, the moulds replaced and another cast in the same moulds. R. GLEASON.

Egan, Dakota.

Singular Upheavals.

To the Editor of the Scientific American:

About three years ago, a company was constructing a wharf at Pyramid Harbor, Chilcat Inlet. The bottom was covered with silt to the depth of about 10 feet, lying on a bed of cement or gravel from 8 to 12 inches thick. Under it is a bed of clay or blue mud.

The piler, on being driven through the cement, would be thrown up with great violence. She was thrown on top of the wharf (that part finished), over 20 feet above the water, it being at low tide, and the rise and fall is about 16 feet. Another time, a pile was driven, and in the gin, with the monkey on it. It was thrown out with such force as to raise the monkey to the top, a distance of 60 feet. The weight of the monkey was 1,500 pounds.

To me it was such an uncommon occurrence, and can be so easily substantiated by respectable parties, the contractor, and the members of the corporation for whom the wharf was constructed, I consider it worthy of notice. W. H. WOODCOCK.

Fort Wrangel, Alaska, April, 1887.

VIOLIN TUNING PEG.

The barrel of this peg may be turned to take up any undue amount of slack that there is in the string connected to the peg, after which the necessary fine adjustment may be obtained by turning the barrel, through the medium of a worm gear. On a tapered wooden core formed at one end with a head or thumb-piece is placed a metallic sleeve formed with an annular flange, against which fits a plate formed with a number of apertured ears, through which pass screws connecting the peg with the instrument. Against the face of the plate is placed a gear, engaging with which is a worm carried by a short vertical shaft supported in bearings extending outward from the plate. The gear is formed with an internal ratchet, Fig. 2, engaged by a pawl mounted in a transverse recess formed in the core and pushed into engagement with the teeth by a spring. In order that the pawl may be withdrawn from the teeth, it is formed with an aperture, which is entered by an eccentric projection formed upon a bar fitted within the core, Fig. 3, and held in position by a pin entering a groove formed in the bar. The end of the string, in connection with which the peg is employed, is passed through an aperture in the core and sleeve, and the slack is taken up by turning the key, the pawl being pressed inward against the tension of its spring. When a tension approaching that required for a proper tuning of the instrument has been imparted to the string, the required accurate tension is obtained by turning the vertical shaft. If the string should break, it may be stripped from the peg by turning the bar so that its eccentric projection will force the pawl against the tension of its spring; and when the pawl has been forced out of engagement with the ratchet, the string may be grasped and pulled from the barrel of the peg, the parts being then free to turn in either direction required.

This invention has been patented by Mr. James H. Gardner, of Elkhart, Indiana.

Another Remarkable Torpedo Boat.

In our paper for April 23 last we gave an account of a new torpedo boat built in London for the Italian government, 140 feet long, 1,400 h. p., 100 tons displacement, which runs 25 knots or 28 miles an hour—the fastest boat ever produced.

Another torpedo boat for the Imperial Chinese navy, by Messrs. Yarrow & Co., had her official trial on March 31, and attained the remarkable speed of nearly 24 knots per hour, as a mean of six runs over the measured mile in the Lower Hope, three with and three against tide. To be exact, the speed was 23·882 knots; and a subsequent run of two hours' duration gave a mean speed of 23·94 knots, with the engines running easy. She had on board her torpedo armament complete and ballast to represent four torpedoes, also a fair quantity of coal and twenty-four persons. This boat is 128 feet long, and constructed on Messrs. Yarrow & Co.'s rapid-steering principle, which enabled her afterward to make circles to both sides, having diameters of about 230 feet.

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STENO-TELEGRAPHY.

Steno-telegraphy is a system of transmission invented by M. G. A. Cassagnes, of Paris, and by its means it is possible to transmit a dispatch in short-hand along a single wire, and to print it at a distant station in stenographic characters with a rapidity exceeding that of any telegraphic apparatus now in use.

By the aid of this machine a practical operator can report at the rate of 200 words a minute, that is, faster than the most rapid orator can speak, 80 to 180 words a minute being the limits of speed for the most grave and the most impulsive. In a fortnight one can learn to read the printed characters, while it takes six months' practice to become a rapid operator.

The object of M. Cassagnes' invention is to cause the stenographic machine to produce this band at a distance—it may be of hundreds of miles—with the same rapidity as it does when the paper is in the machine itself. To this end the keyboard and the printing mechanism are connected by a telegraphic wire. Currents from the transmitter are collected by a moving rubber, which transmits them in succession to the line, and at the distant end they are received by a similar rubber, which distributes them in proper order to the corresponding magnets which work the dies. Thus each key is put in electrical connection with the corresponding die several times a second, and if it is depressed, a current is sent to operate the die.

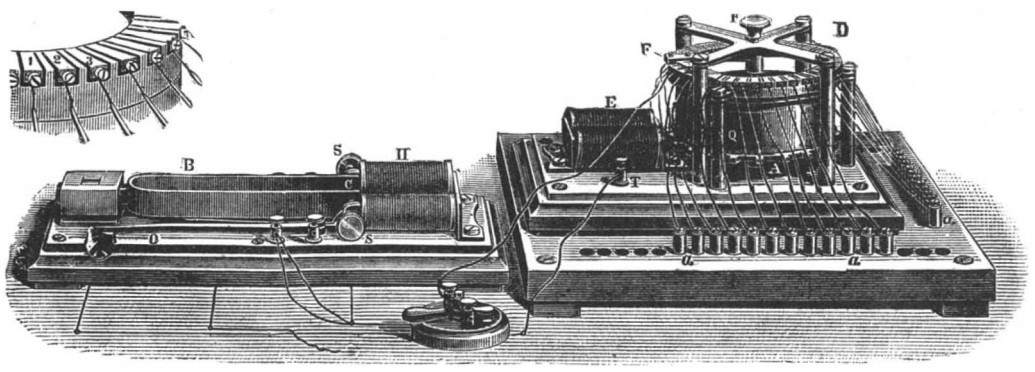


Fig. 3.—THE TRANSMITTER.

Figs. 1 and 2 are diagrammatic illustrations of the steno-telegraphic system, and Figs. 3 and 4 perspective views. They represent respectively the transmitting and receiving apparatus. The keyboard at the transmitting station is composed of twenty keys, furnished with electrical contacts connected alternately to two positive and negative battery poles, P P¹, the middle of the battery being put to earth. These keys are in connection with the contact segments of the distributer, D. A rubber, F, keyed on the axis of the soft iron toothed wheel, A, is driven continuously, and in passing successively over the contacts it puts them in communication with the line. If it be understood that there exists at the receiving station (Fig. 2) a similar distributer, D¹, of which the rubber, F, turns in perfect synchronism with that of the transmitting station, and of which the segments in contact are in connection with the polarized relays, R^3, R^4, R^5, ... R^{20}, it will be seen that the currents emitted by the depression of the keys at the transmitting station will be received at the distant station in the bobbins of these polarized relays, which will act on their armatures, and will close the circuits of the local battery, P^1_3. The currents furnished by that battery will work the dies of the printing apparatus corresponding to the keys depressed by the operator.

When the stenographic signs corresponding to the keys touched have been printed on the band of paper in the receiver, that band receives a slight movement in advance, in order to permit of a new line of characters, and so on. There is thus obtained by a single wire the exact reproduction of the paper band already described. The printing mechanism (Figs. 1 and 2) comprises twenty dies carrying the stenographic signs corresponding to the twenty keys of the transmitter. Each of these dies can be pressed against the band of paper by the action of the armature of the corresponding electro-magnet. There are twenty of these magnets, the bobbins, *e e e*, of which are connected at one end to the terminal, V, and at the other end to the posts, v_1 v_2 v_3 v_4, of the relays.

Having described the principal features, we will now turn to the details. A stenographic line corresponds to the depression of a certain number of keys, twelve at the most. Suppose, for example, that the keys 3, 4, and 6 are depressed. At the moment when the rubber, F, arrives at the contact, 3, the corresponding rubber, F, is on 3^1, a current traverses the line and draws down the armature of the relay, R_3, upon the post, v_3, the battery, P^1_3, is connected to the electro-magnet, e_3, and the die, p_3, imprints its character upon the band of paper rolled upon G and passing under the dies. The next instant the rubber reaches the contacts, 4, 4^1, then 6, 6^1. The battery, P^1_3, is successively connected to e_4, e_6, and the dies, p_4, p_6, are drawn down, the band of paper remaining stationary. At the moment the line is complete, the relays are readjusted by aid of local currents.

When the last is replaced, no current traverses the circuit of the battery, P^1_3, the armature of the electro-magnet, M, which is in this circuit, is free, and the paper advances by an interval corresponding to a line. A second combination of keys is then depressed, and a fresh line printed, and so on. After each emission of current the line is put to earth by the movement of the rubbers.

In order that such results may be obtained by a single wire, it is imperative that the rubbers shall move with perfect synchronism, and to obtain this the phonic wheel of M. Paul la Cour, of Copenhagen, is employed. The phonic wheel consists of an electric tuning fork, the vibrations of which are maintained by the intermittent passage of a current from the contact battery, P, through the bobbins of the electro-magnet, H. These interruptions are produced by the vibrations of the fork itself, which close and break a contact at the extremity of one of its branches. The vibrations of the second branch are employed to send currents, also intermittent, from the battey, B, into the bobbins of the electro-magnet, E. In order to prevent sparks at the point of rupture of the circuits, two shunts of high resistance are arranged round those points. Opposite the poles of the electro-magnet, E, is a wheel, A, of soft iron, provided with teeth on its circumference, and having on its axis a wooden box filled with mercury and designed to act as a flywheel. Also upon the same axis is the rubber, F, which travels over the distributer, D.

If the wheel be rotated in the first instance by hand, it will continue to turn by reason of the successive attractions on the teeth by the poles of the electro-magnet, E. The wheel will assume a speed which will be determined by the number of vibrations of the forks and by the number of teeth in its circumference. This speed will be sensibly constant.

The receiving apparatus comprises a set of similar apparatus, and if the two wheels have the same number of teeth, and the tuning forks have been regulated to give approximately the same number of vibrations, the two speeds will be about the same. To render them absolutely identical, the sending distributer carries two special contact pieces connected, the one to the positive line battery and the other to the negative. At the corresponding point of the receiving distributer (Fig. 2) there is a single contact, which is in connection with the bobbins of the polarized relay, *r*. The wheels being set in movement and their speeds not being exactly equal, a moment will arrive when the rubber, F, will pass over one of the two correcting contacts at the sending station, just as the rubber, F^1, is on the correcting contact at the receiving end. At this instant there will flow into the relay, *r*, a current, positive or negative, according as F is on one or other of the correcting contacts. The current will make the tongue of the relay move to one side or the other, and will introduce into or cut out of the circuit of the battery, P^1_2, an adjustable resistance. It will thus send more or less current into the coils of the electro-magnet, H^1, and the tuning fork, B^1, will vibrate more slowly or more rapidly as the case may be, with the result of maintaining itself sensibly at the same speed as B. The two wheels will make the same number of revolutions, and the two rubbers, F and F^1, will be on corresponding contacts at the same time.

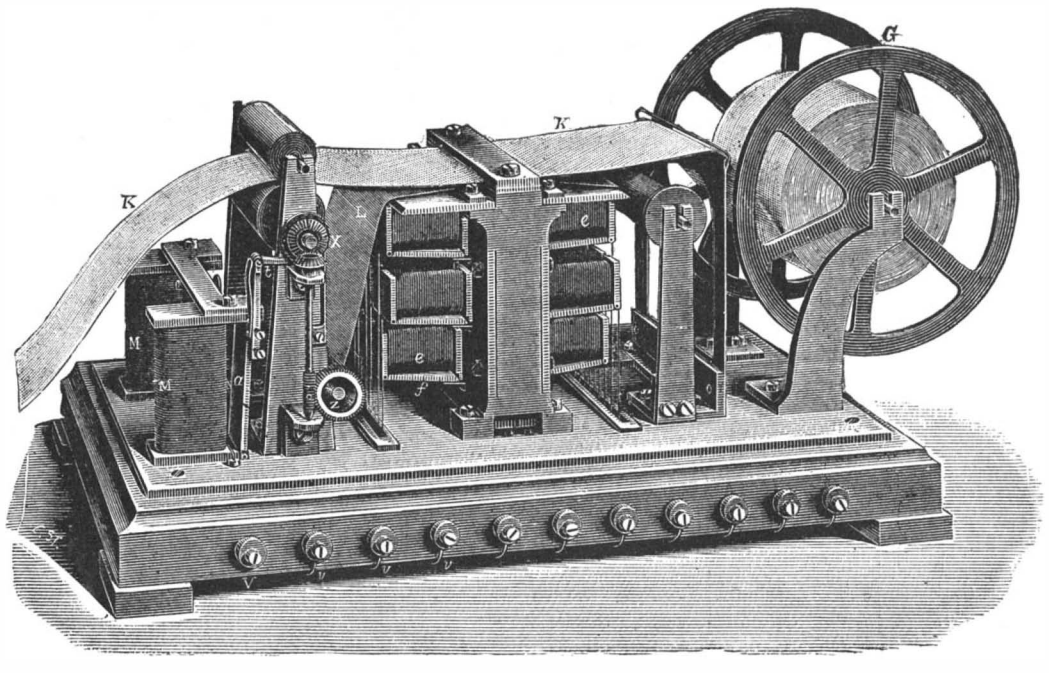
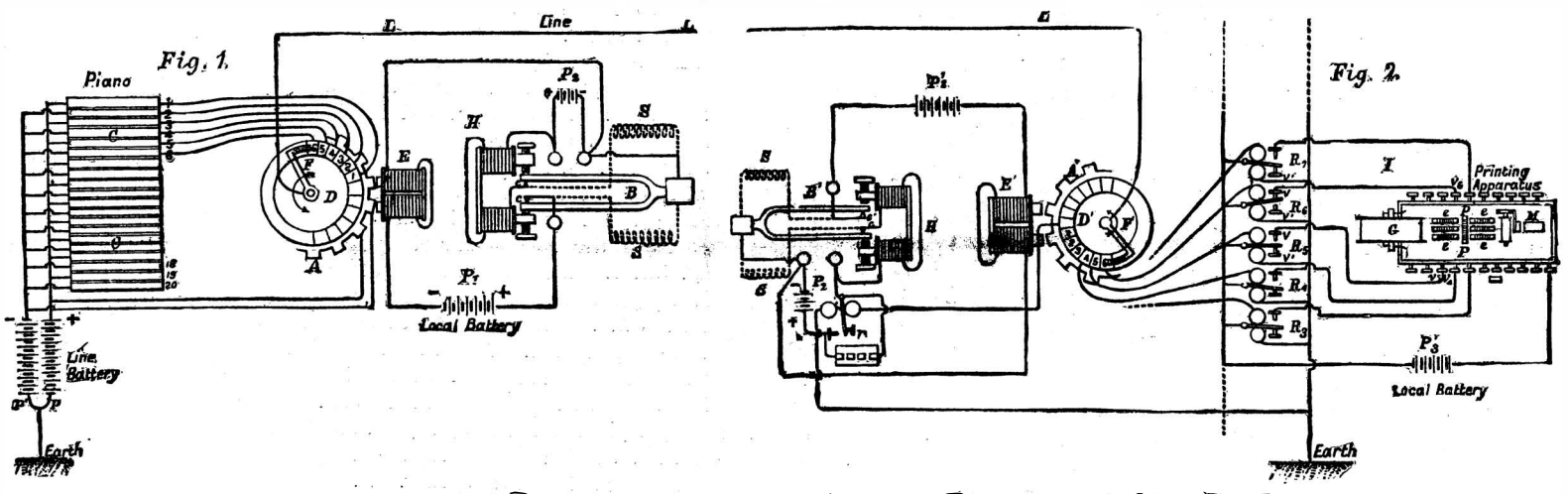


Fig. 4.—THE RECEIVING APPARATUS.

The steno-telegraph has been subjected to several series of experiments. In the first the transmitting and receiving instruments were placed side by side in a room at the Ministry of Telegraphs, and were connected by a telegraph wire making a considerable circuit. Each instrument had a separate earth contact. In the first experiment (October 28, 1885) an underground circuit of 28¾ kilometers was used. In the second the line ran from Paris to Orleans and back, 245 kilometers (152 miles); in the third it was the same; in the fourth,



DIAGRAMS OF THE CASSAGNES SYSTEM OF TELEGRAPH TRANSMISSION.

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from Paris to Tours and back, 480 kilometers (298 miles); in the fifth, Paris to Havre and back, 290 miles; in the sixth, the same; in the seventh, Paris, Rouen, and back, 180 miles. In some of the circuits there were sections of underground lines, varying from 19 to 22 kilometers, and the resistance of the entire circuits varied from 1,650 to 3,100 ohms. These trials were made under the conditions usual on French lines. The battery did not exceed 100 Calland or Daniell cells, and the wire was of iron with a maximam diameter of 5 mm. With stronger batteries and bronze and copper wires, greater speed can be obtained.

Since commencing the trials, M. Cassagnes has added further improvements to his apparatus. These consist in the addition of a mechanical perforator and an electrical transmitter, thus bringing the steno-telegraph into the category of automatic telegraphs. By the use of a perforator, the keyboard no longer produces the electric contacts directly, but produces mechanically a band on which the signs are represented by holes. This perforated band is placed in the transmitter and drawn through by the same mechanism which effects the rotation of the rubber. A system of feelers emits through the holes in the band the currents which actuate the dies at the distant station. In a series of trials, between Paris and Orleans and back, Paris and Tours and back, Paris and Macon and back, and Paris, Angouleme, and back, distances varying from 200 to 920 kilometers, there was obtained with this apparatus the following speeds of working: Up to 350 kilometers (217 miles), 400 words per minute; up to 650 kilometers (403 miles), 17,000 words per hour; up to 900 kilometers (560 miles), 12,000 words an hour. Each section can act equally well for reception as for transmission, and the results mentioned above represent the total number of words transmitted in either direction, according to the requirement of the stations. —*Engineering.*

The Introduction of Cholera into Chili.

Dr. John Trumbull sends an interesting account of the mode in which the cholera found its way into Chili, despite the greatest precautions taken to prevent its entrance. "No country," he writes, "could be better situated than Chili to withstand the attempted invasion of such a disease as cholera. No better boundaries could be desired than the extensive desert on the north, separating the country from Peru and Bolivia, the Pacific on the west, and the unbroken mountain range on the east. The Andes, furthermore, form a natural watershed, thus preventing contamination of the water supply by the inhabitants of neighboring countries. The sole danger therefore lay in importation of the disease by infected clothing or in the person of fugitives from the eastern side of the mountains. Every port of Chili was absolutely closed to vessels coming from the eastern coast of South America, and guards were stationed at the mountain passes. A dozen of the most frequented passes were thus closed, but, the winter being a dry one, the fall of snow was light, so that more than a hundred of the less well-known passes are said to have been open. The introduction of the disease was traced directly to a party of fugitives coming from the Argentine Republic, where cholera prevailed. A cattle dealer, with four servants, crossed the mountains and remained concealed for a time in the village of Santa Maria. One of the number was sick, and five days later, on Christmas, 1886, the first authentic case of cholera occurred in the person of a laborer in that village. As soon as the nature of the disease was recognized, a military cordon was placed around the infected district, and the branch railroad leading therefrom was closed. But an exodus from the place had already commenced, and on December 30, one of the fugitives died immediately after his arrival at a small station of the main railway line, forty-five miles from the seaport. Four days later the man who had attended this case sickened and died, and thus a second center of infection was established. This case was an exception to the general manner of the spread of the disease, the water having been the carrier of the infection. In Chili, artificial irrigation is relied upon in agriculture, and the river water is carried through small canals (*acequias*), traversing the valleys in every direction, and furnishing the supply needed for drinking, cooking, and bathing. The canals then act as sewers, the water-closets being built over them, are next used for purposes of irrigation, and finally empty again into the river. No cordon could be of avail under such circumstances, and it was along the banks of the acequias carrying the waste matter from the village of Santa Maria that the disease next disclosed itself. After that a section of country miles away, but on the bank of the same river, and drawing its water supply from this source, was invaded. As yet the disease has not spread from the district supplied by the Aconcagua River, but several suspicious cases have appeared elsewhere, and much anxiety is felt concerning the future." Dr. Trumbull's letter, of which we have been compelled from pressure of other matter to give but an abstract, possesses a peculiar interest, since it seems possible that the disease may be brought to this country from the west coast of South America. Cases of suspected cholera are said to have been noted at the Isthmus, and if the disease becomes prevalent there, there will be great danger of an invasion of our own country.—*Med. Record.*

THE PORCUPINE IN THE BERLIN ZOOLOGICAL GARDEN.

THE PORCUPINE IN THE BERLIN ZOOLOGICAL GARDEN.

The class of rodents includes mostly harmless animals, such as the dormouse, the beaver, the mouse, and the hare, and none of them, except the family of the porcupine, are armed with weapons of attack or defense. All the members of this sub-class are armed with longer or shorter pointed quills, and to these lance-bearing rodents the Canada porcupine (*Erethizon dorsatum*) belongs. This animal is about 2½ feet long, and its body is covered with thick, dark brown hair, from which project quills which are 3 or 4 inches long. Its head is short and thick. Its long and strong claws, of which it has four on its fore feet and five on the hind ones, are of the utmost importance to the animal in gaining its food. Its tail is a weapon to be dreaded. It is about 7 inches long, is flattened, and is provided with bristles underneath and spines on top. Woe to him who comes near this weapon! Quick as lightning, the animal strikes laterally with it, and is sure to hit his real or imaginary foe.

The quills will penetrate the thickest covering, and remain in the skin of the person attacked. If this porcupine cannot use its tail to advantage, it rolls itself into a ball like the hedgehog and presents a wall of spears to his attacker, and in this position it seems really unconquerable. A dog which has risked an attack turns back after the first bite, terrified and howling, for the spines stick fast in his mouth. A naturalist found a lynx which had suffered severely from such a combat. It was nearly dead, its head being very much inflamed and its mouth full of quills.

The same observer states that dogs, wolves, and even the cougar die from similar wounds. If a hunting dog comes in contact with a porcupine it is sure to be badly hurt, and therefore porcupines are heartily disliked by hunters.

The *Erethizon dorsatum* lives in the woods of North America, spending most of its time on trees, which it climbs with wonderful ease. Its food is the bark of trees, and it will entirely strip young branches, especially of elms and poplars, so that the woods inhabited by this animal look, as a certain naturalist says, "as if a fire had raged in them." Indians eat its flesh, and use the quills for decorating belts, hunting bags, etc. In captivity, the Canada porcupine soon becomes tame, and accustomed to its keeper; but as soon as occasion offers will escape to the trees.—*Illus. Zeitung.*

Extracting Tin from Tinned Sheet Metal Cuttings.

BY S. MONTAGUE, NANTES.

This invention consists in conveying hydrochloric acid gas into a closed vessel containing the tinned sheet metal, the separation of the tin of which is desired. After the closed vessel has become completely saturated with hydrochloric acid gas, whereby the latter combines with the tin, a shower of water is allowed to fall over the sheet metal, and the gas is converted into liquid protochloride of tin; the tin, entirely removed from the sheet metal, is dissolved in the protochloride of tin. The protochloride is drawn off, and the tin is precipitated either by means of zinc or by lime wash, the tin obtained being almost pure.

THE following is said to be a good recipe for map engraving wax: Four ounces of linseed oil, half ounce of gum benzoin, and half an ounce of white wax; boil two-thirds.

BRILLIANT RED COLORING MATTER.—Professor Rennie, of Adelaide, has examined the coloring matter which is present in the tubers of *Drosera whittakeri*, a plant which grows plentifully on the hills in the neighborhood of Adelaide. Mr. Francis, of Adelaide, had previously extracted the coloring matter by means of carbon bisulphide, and found that it could be used for dyeing silks with various mordants. The substance is of a brilliant red color, is volatile, and can be obtained in a crystalline condition. The yield from the tubers is very small, as four quarts were required to furnish 5 grm. of the pure dye. By suitable solvents, it can be extracted from the root, and obtained in a state sufficiently pure for analysis. The numbers obtained by Prof. Rennie agree with the formula $C_{11}H_8O_5$, and from subsequent investigation, it appears that the compound is trihydroxymethyl naphthaquinone.

After crystallization of the dye, the mother liquor was further examined, and found to contain another derivative of methyl-naphthaquinone; but additional experiments are needed before the exact nature of this second compound is satisfactorily determined. It remains to be seen whether, with such a small yield, the plant can be grown in sufficient quantities to produce a dye which is capable of competing with the artificial coloring matters of similar constitution.

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The Margin of Profit.

Edward Atkinson lectured on Sunday, May 1, in New Era Hall, Boston, before the Central Labor Union. He said in part:

Even to those who make the Sunday more of a holiday than a holy day, I may give a text to this sermon on labor: Do justly. Love mercy. Walk humbly. These are the laws of humanity, however they originated. There are none who need to think of them more than some of you who try to prevent other men from getting their living in their own way, who would deprive them of their liberty of action, and who put a bad name upon them if they don't do what you undertake to tell them to do.

A great many of you work too hard and too long. No one can deny that. You don't get as good a living as you might have. There is no doubt about that. You don't want to work more than eight hours a day if you can help it. Neither do I. I don't work more than eight hours a day in order to get a living, and you do. Why should you not control your own time as well as I? You can if you choose to.

There is one kind of work that I know all about, and that is making cotton goods in a mill. I have been working about cotton mills in one way and another ever since I was a boy. When I first went into a store in 1842, the men and women who worked in the cotton mills worked thirteen or fourteen hours a day, and they could not begin to make as much cloth in a day as they do now, while they only earned half as much wages. The owners took a bigger slice out of every yard for their profit than they do now; but the product was so small that even the big slice out of each yard did not make them very rich.

It was just the same in every other kind of work then as it was in the cotton mill, longer hours, harder work, poorer pay; too long, too hard; but it took all that time and all that labor to raise food enough, or to make cloth enough, or to get fuel enough to go around. Where it took thirteen or fourteen hours then, it now takes but ten. You older men remember. Am I not giving you facts? By and by it will take less. I think it very likely that your children will be able to get just as good a living, and perhaps a better one than you do, by working eight hours a day; but they won't get it by acts of the legislature.

Nothing has become so cheap as cotton cloth. When you buy 40 yards of cotton cloth at $2.50, you pay the owner of the mill 15 cents profit, but you also pay about 15 cents more to other people for profit, that is 30 cents profit in all; and you pay $2.50 directly for labor.

Five men and women—two carding, two spinning, and one weaving—can in one day make eight yards of cloth, a great deal coarser than this; this is equal to one person's work for five days; 40 yards would take five times as much, or 25 days; and when you had the cloth you wouldn't wear it any more than you would wear a crash towel if you could get anything else, because it would be so coarse and so rough; therefore you pay a capitalist 15 cents profit on 40 yards of cloth, in order to save yourselves 23 days' work (mighty hard work at that) in getting good, smooth, soft factory cloth instead of coarse, wiry, rough homespun. Who gets the best of that bargain? If your work is now worth $1.50 a day, and you save 23 days, I make it out that the capitalist who owns the mill saves you $34.50 and charges you 15 cents for doing it. I have taken cotton cloth as an example, and it is the worst example that I could take to prove the service of capital.

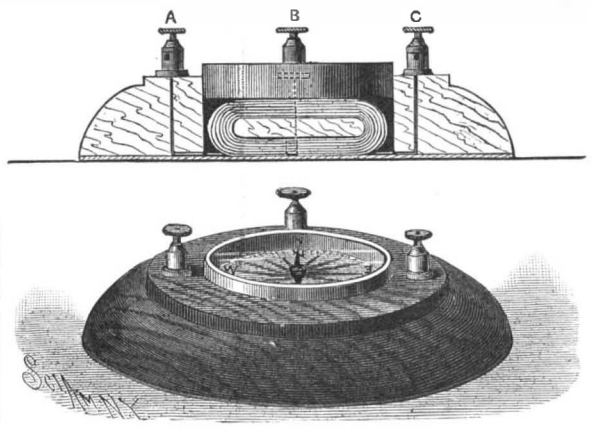
I wholly approve of the organization of labor. What is needed now is a club of "scabs," that is a liberty club, a mind-your-own-business club. If you have Knights of Labor, why not have Squires of Work? It is a great blunder to say that while the rich are growing richer, the poor are growing poorer; it is only the poor who can't work well or who won't work well who grow poor while the rich are growing rich in this country. The best times for the manufacturer are the times when he makes the most money, and they are always when the wages are highest and not when they are the lowest, because wage earners are their principal and most important customers. Therefore, I tell you, organize, organize; but organize the squires of work; call in all the "scabs" to join, and don't refuse any man who works for his living, either with his hands or his head, with his own capital, or his own tools, or his own brains, if he is an honest and a true man.

There are two things very much needed in these days: First, for rich men to find out how poor men live; second, for poor men to know how rich men work. I despise this talk about the rights of labor. The poor man has no more rights than the rich man. What you want to think about are the rights of man, whether he be rich or poor. I tell you here and now that by the acts of the legislature which you have tried for, and some of which have been passed, and by way of by-laws of your Knights of Labor, your clubs, and your associations, which you have tried to force people to adopt, you are driving capital out of the State of Massachusetts. The "scabs" of this country have managed their own affairs fairly well, without much regard to your meddlesome acts. The result of that has been that the men of special skill, who are at the head of their trades, are 100 per cent better off to-day than they were twenty years ago and more.

A SIMPLE GALVANOMETER.

A useful galvanometer, and inexpensive, may be constructed as follows:

A hardwood base, a few inches in diameter and about an inch in thickness, carries a small pocket compass, set firmly into the base over a silk-insulated wire, the ends of which are attached to binding posts on the upper side. The writer has made a neat instrument at a cost of 80 cents—better than he could buy under $5. The compass may be bought at hardware stores for 30 cents. It is well for the purchaser to test the compass, before buying, with a magnet. Select the one that is swift to obey the influence of the magnet. Then



A SIMPLE GALVANOMETER.

mark out upon the upper side of the base the outline of the compass. With a knife sink the circle thus outlined an eighth of an inch, as a pocket for the compass.

Cut the wood so as to form a bobbin, upon which is wound wire, as shown in the upper sectional view. This should be laid carefully, one end being left for attachment to binding post A, and the wire being wound about the core by passing the other end through the openings, and then attaching it to the binding post, C. About 20 feet of good quality, silk-covered wire, of size between 26 and 32, is amply sufficient. After the wire has been wound upon the core there may be attached to it, with a little care, at its middle, a short piece that will connect with a third binding post, B. This will make a short circuit of one-half the length of the wire, when terminal A or C is connected with terminal B. A fine gimlet hole will serve to carry each end to its binding post, where it is best attached to the foot of the post, leaving the holes in the posts for other connections. A circular piece of tin may then be fastened to the base, so as to cover the wire, and the whole base may then be varnished or oiled to suit the fancy. The compass may be firmly united to its receptacle with a bit of Chatterton compound or glue, care being taken to set it perfectly level.

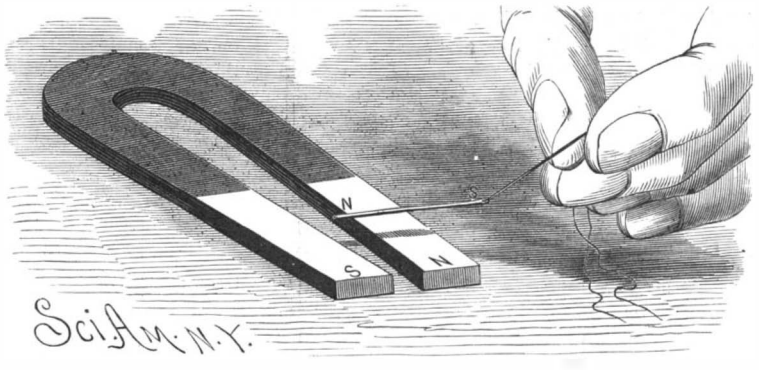
An instrument thus constructed will be sensitive to delicate currents, and forms a useful galvanoscope for amateur and professional electricians.

GEO. C. SONN.

Newark, N. J.

EXPERIMENT IN MAGNETISM.

Material, a horseshoe magnet and a common sewing needle. Insert a light thread in the needle, tie, and cut off one end, leaving a single thread 6 or 8 inches long. Lay the magnet on a table, with poles in front;



EXPERIMENT IN MAGNETISM.

magnetize the needle by rubbing it several times, always in one direction, by one pole of the magnet, after each stroke returning the magnet in an arc through the air. Take the end of the thread between thumb and finger, and suspend the needle over its attractive pole, allowing the point to come within one-fourth of an inch of the magnet, then, with a circular sweep of the hand, to keep the point in position, draw the eye of the needle down toward the other pole. This, if carefully done, will bring the needle to a horizontal position, where it will remain, floating or in suspension, as long as the thread is held steadily. The magnetic forces operating to produce this effect appear to be, first, the attraction of the left pole for the point of the needle; second, the repulsion of the right pole for the same point; and third, the attraction of the right pole for the eye of the needle, which is resisted by the thread supporting the needle; the latter also is held from approaching the left pole by the same means.

WM. SALISBURY.

[We illustrate this very interesting experiment. It can be performed with quite a small magnet. A 2 inch magnet answers perfectly. In using a small magnet, the point of the needle should be broken off to reduce it in length. The thread may be held close to the needle; an inch length of free thread is enough. The experiment may be made more effective by covering the magnet with a sheet of paper, thus concealing it.—ED.]

Protecting Animals from Flies.

At this season of the year the annoyance caused to animals by flies and mosquitoes often amounts to positive agony, and at all times, in what is called good corn weather, it is sufficient to prevent the stock eating enough to keep them in good condition. The animals will stand in the water or pass the greater part of the day in the shade, rather than expose themselves to the sunshine, going out to eat only when driven by hunger. They quickly lose flesh, the flow of milk shrinks, and a loss is incurred that cannot be easily made good again. At all times a good feed of grain is beneficial to stock, but it is especially so when flies are very annoying, since it will do much to prevent shrinkage of flesh and milk. Horses and milch cows may be protected, in a great measure at least, by wiping them all over with a sponge dipped in soap suds in which a little carbolic acid has been mixed. Bulls confined in stables often suffer enough from the attacks of flies to drive them half mad, and there is no doubt that the continued fretting caused in this way develops a savage disposition. The most satisfactory results have followed from sponging with soap suds and carbolic acid mixed a Jersey bull confined in a stall.—*Chicago Tribune.*

THE MECHANICAL WORKING OF BALLAST QUARRIES.

It is more than fifteen years ago that the engineers of the Paris-Lyons-Mediterranean Railway Company recognized the necessity of keeping the ballasting of the roadbed thoroughly permeable, and of restoring such permeability to ballast that has lost this quality through long use. They adopted as a principle that ballast should be kept in just as good a state as are the rails and ties. This principle once admitted, it became necessary to replace the old ballast, and to open up vast quarries in the gravel deposits that are found in the vicinity of several lines of the above named railway system. But, since this gravel is usually mixed with a somewhat earthy sand, and furnishes a ballast that quickly becomes as impermeable as that which is to be replaced, it has to be given greater hardness by freeing it of its sand through a rapid screening. This operation is now performed mechanically.

When ballast quarries first began to be worked mechanically, the machine used consisted of an excavator, which emptied the contents of its buckets upon inclined screens, through whose bars the sifting was effected. But, in the presence of the enormous cubage of the ballast to be furnished, not only for the construction of new roads, but for the repair of old ones, contractors soon had to modify their mode of operating, and to often substitute new and more powerful machines for their old ones.

In 1885, Messrs. Martin & James, having taken the contract for ballasting the line from Arron to Nogent, adopted the following interesting arrangement. A pump actuated by the excavator engine threw a continuous stream of water into a horizontal hopper, and as this water carried along the sand mechanically, nothing remained but the broken stones, which fell perfectly clean into the cars. These stones were afterward sorted out by means of screens, and the ashlar separated from stones at least two inches in diameter, or else the whole was allowed to fall pell-mell into the cars. The water charged with sand returned to the excavation from whence the ballast had been taken by the excavator buckets.

It took twelve minutes to fill a car with silicious ashlar of all dimensions, and two minutes to load a car with 35 cubic feet of the material. Messrs. Delamare & Pautz, who recently contracted with the Paris-Lyons-Mediterranean Railway Company to furnish 2,800,000 cubic feet of ballast for the line from Lyons and St. Etienne, placed in the Pierre Benite quarry an excavator (Figs. 1 and 2) provided with a mechanical device designed for effecting the screening. In this machine, the usual chute was replaced by a rotary cylindrical sieve, designed to free the gravel from the sand and earthy matter that it contained. The bucket chain of this excavator was

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actuated by a 25 horse power engine. The number of buckets was 16, and the capacity of each was 2½ cubic feet. The rotary sieve was 7 feet in length and 3¼ feet in diameter, and was formed of steel rods ½ inch in diameter, and spaced four-tenths inch apart. It was actuated by a cogwheel and a pinion that were driven by the gear wheel of the excavator. Its inclination, which was variable, was determined by the more or less earthy nature of the gravel. Its velocity was 30 revolutions per minute. By means of cams actuated by a motion derived from the sieve axis, four hammers alternately struck the sieve bars, and thus prevented the sieve from getting choked up. Owing to the rapid rotary motion of the sieve, and to the action of the hammers, each of which gave 50 blows per minute, the gravel came from the cylinder sufficiently freed from sand and earthy matter, and dropped into the iron plate receiver of the elevator, which latter consisted of a second chain of buckets, actuated by a 6 horse power engine, and elevated enough to empty the sifted gravel on a bank 22 feet in height. The detritus that passed through the sieve entered a chute placed beneath, and fell into cars that carried it away. A part of this detritus formed a deposit, and another part of it served to fill in the cutting made by the excavator, and to constitute a platform for the latter, which had to move forward in measure as the gravel was removed.

The excavator, which was mounted on a pivot fixed to a truck, was capable of running forward or backward, or of describing about a third of a circle, through the intermedium of a small motor carried by the truck. Motion was transmitted through pitch chains. At the top of the bucket frame there were two strong springs, which were connected by chains with the frame of the excavator, and which, in case of resistance, permitted of a to and fro motion, so as to prevent those breakages that inevitably occur when the bucket of an excavator comes into contact with a very hard object. The rotary sieve was so adjusted that it could, in a short time and at slight expense, be removed, and a chute be substituted for it in ordinary excavating.

As soon as the 2,800,000 cubic feet of ballast were obtained, the chute was substituted for the screen, and the excavator was used for loading the railway cars with the material.

The elevator, which was mounted on a truck, was moved by hand, through the intermedium of a winch, followed all the backward and forward motions of the elevator. It was provided with 27 buckets, having a capacity of 1,400 cubic feet, and 21 of these were discharged per minute.

During the eight hours of effective work, about 10,500 cubic feet of screened ballast were put upon the pile. The force consisted of two enginemen, one stoker, one foreman, two carmen, ten laborers, and four horses.

In order to extract 10,500 cubic feet of gravel, and screen it by hand, and deposit on a pile to a height of 22 feet, it would have taken 6 pickmen, 25 screens, 8 men for removing the detritus, 20 for taking up the screened ballast and putting it into the cars, 4 laborers for unloading the cars and keeping the tracks in order, and 10 horses. This would have entailed a daily expense of at least $96.

Fig. 1.

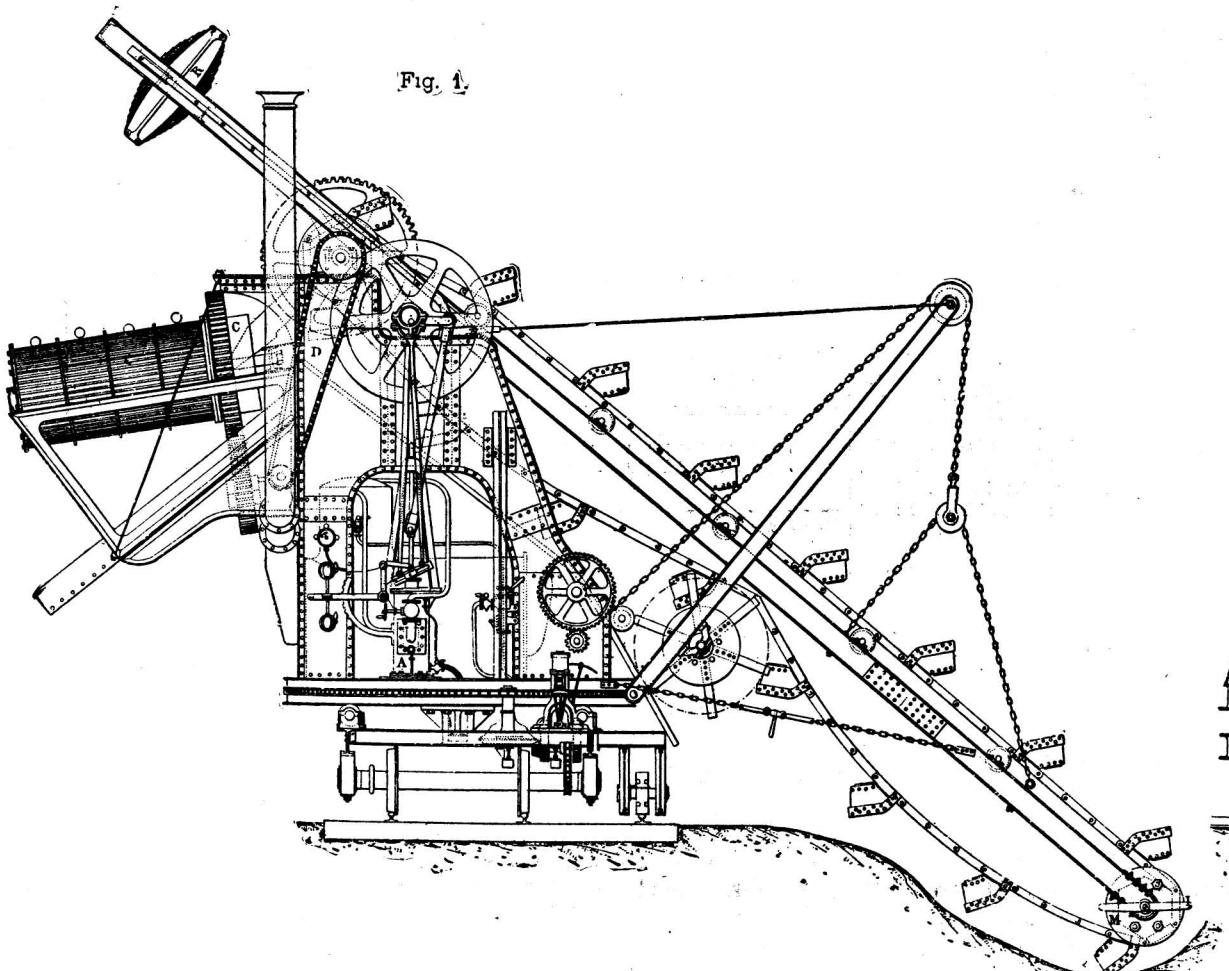
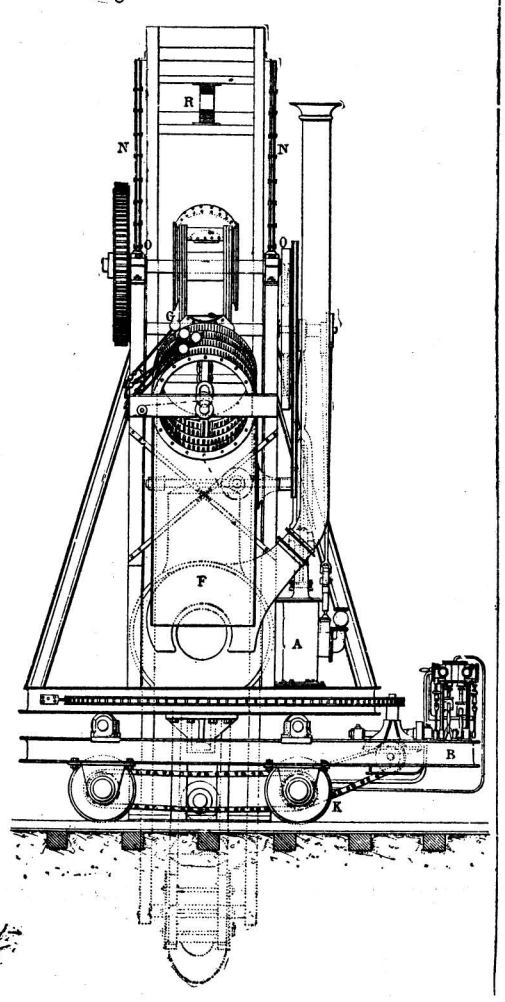


Fig. 2.



EXCAVATOR WITH ROTARY SCREEN. (Scale 1-60)

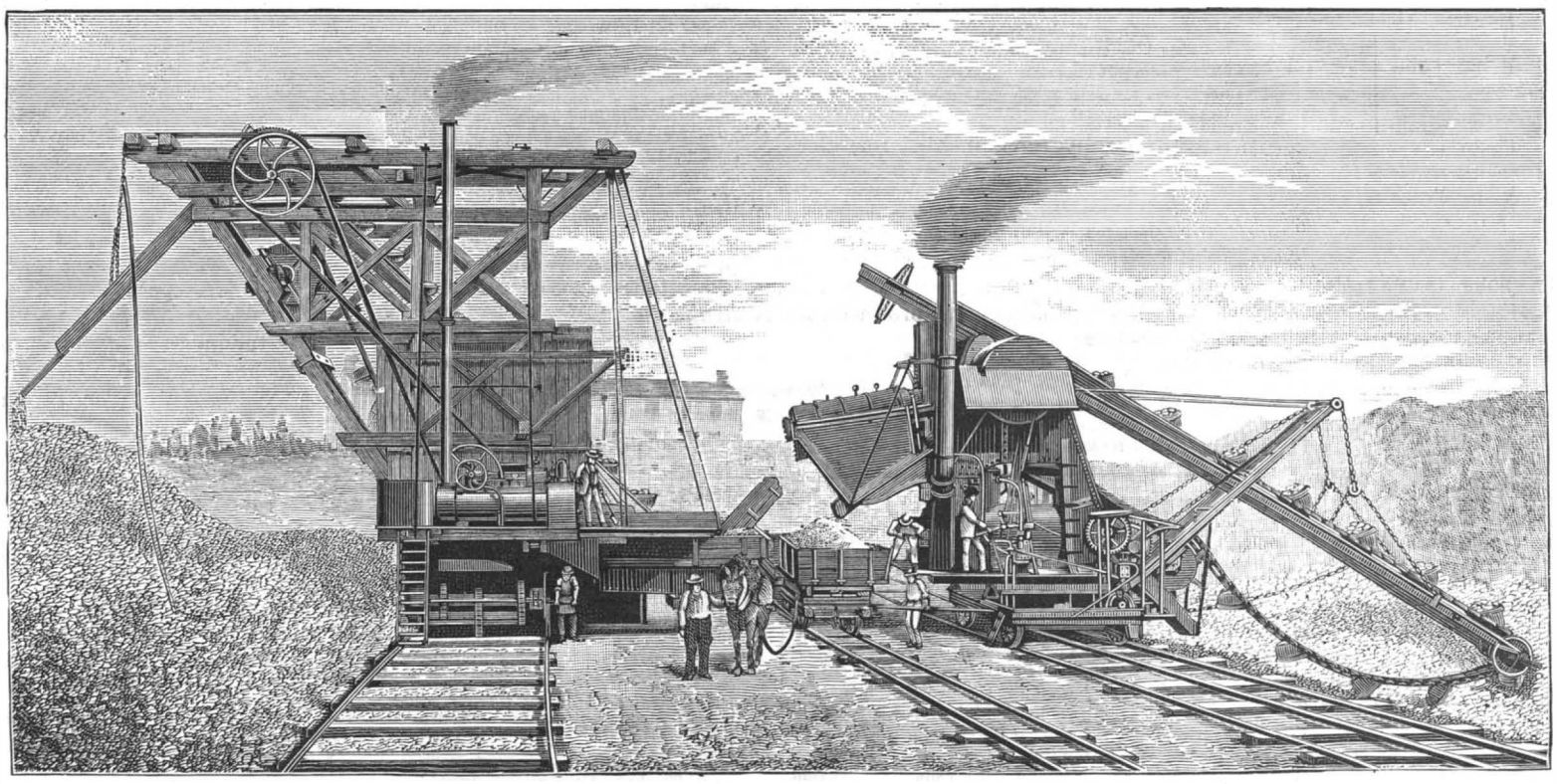


Fig. 3.—GENERAL VIEW OF AN EXCAVATOR AND ELEVATOR AT WORK IN A BALLAST QUARRY.

DESCRIPTION OF FIGS. 1 AND 2.

A, motor for actuating the bucket chain. B, motor for giving the excavator a rotary and alternating motion through the pitch chains, J and K. C, screening cylinder. D, pitch chain for actuating the screen. E, gearing for giving the screen a rotary motion. F, chute. G, hammers actuated automatically by the belt, H, and the cams, I. L, knife to prepare a passage for the tumbler, M. R, springs for giving elasticity to the bucket frame. N, chain connecting the springs with the frame at the point, O.—*Abridged from Le Genie Civil.*

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ENGINEERING INVENTIONS.

A boiler has been patented by Mr. Joseph Leightham, of Lebanon, Pa. The invention covers boilers arranged in the furnace, with tubes surrounding the fire chamber above the grate bars and connected by branch pipes with the boilers, with a superheater held above the boilers and connected with them by branch pipes, and a mud drum held below the boilers, with other novel features.

A sliding door lock has been patented by Mr. Edward B. Searles, of Baltimore, Md. It is a car door fastening, comprising a plate with a series of undercut sockets and a slot connecting them, with a block having a portion adjustable into any one of the sockets, and movable in the connecting slot from one to the other, by which the door may be made fast closed, or open to any desired degree.

A car coupling has been patented by Mr. George J. Ferguson, of Greenville, Tex. This invention provides a locking and unlocking device to be placed entirely outside of end of car, to allow any mode of attaching drawheads, the unlocking device being self-retaining in uncoupled position, and permitting operator to uncouple and leave cars uncoupled without their being pulled apart, while it is unnecessary to go between the cars for coupling and uncoupling.

A tubular hot air furnace has been patented by Mr. Frederick Shriver, of Grand Rapids, Mich. The shell of the chamber is made of plate iron, with the lower part of the vertical section lined with fire brick, to form a fire chamber, and resting upon a cast iron bed plate, the latter supporting a fire grate resting upon a brick foundation, with other novel features, making a furnace that can be readily cleaned and repaired, is easily built, and will be effective and durable.

A combined steam and hot air furnace has also been patented by the same inventor. It is so constructed that a large amount of water-heating surface and air-heating surface are exposed to the direct action of the products of combustion, and that all the parts of the furnace can be readily cleaned and repaired.

AGRICULTURAL INVENTIONS.

A hay stacker and loader has been patented by Mr. Hubert L. Dewing, of Valley Center, Kansas. This invention covers a novel construction and combination of parts, so designed that the hay can be readily drawn upon the carrier, easily elevated, and dropped closer to or further from the rear side of the machine, as required.

A plow jointer has been patented by Mr. Thomas Lowden, of Lowell, Mass. It may be used as an attachment to any form of plow, and is so constructed as not to perceptibly increase the draught of the plow, being an improved form of device used for cutting off the edge of the furrow slice and depositing it in the previous furrow.

A sulky plow has been patented by Messrs. Joseph Marx and Adrian Virnig, of Cross Plains, Wis. It is designed so that two plows, preferably right and left hand plows, may be used alone or both together, in preparing lands or for cutting ditches and drains, and is arranged for conveniently guiding the machine and for regulating the operation of the plows, the colter, and the draught tongue, for working to any desired depth.

A hay gatherer has been patented by Messrs. James H. and Simeon W. Humphrey, of Platte City, Mo. It has a row of teeth forming a rake for gathering the hay, slats which form tables for the hay to accumulate on, and which may be used to assist in piling the hay upon the machine, turning the hay over upon itself and also in unloading, with levers which regulate the teeth for gathering, carrying the load, or traveling upon the road.

MISCELLANEOUS INVENTIONS.

An excavator has been patented by Mr. Howard W. Roop, of McMeekin, Fla. The apparatus consists of a shore pulley and its driving mechanism, a bog anchor and its pulley, an endless cable passing around the pulleys, and a detachable excavator bowl adapted to be operated by the cable from the shore upon the edge of a bog.

A breast pump has been patented by Mr. Anaximander B. Tutton, of Sioux Falls, Dakota Ter. It is so constructed that the force of the suction is partly upon a water leg or column of water and milk in a long siphon tube, modifying its effect, while the pulsations of the bulb are broken up and rendered more like a uniform suction.

A toy carrousel has been patented by Mr. Samuel Pinnell, of Brooklyn, N. Y. Combined with the handle is a frame pivoted thereto at its center, weighted to throw its center of gravity off the pivotal center and adapted to be oscillated by and with and revolved by the handle, with a series of figures fixed to the outer part of the frame.

A method of ornamenting curtain poles has been patented by Mr. Theodore J. P. F. Lindberg, of Brooklyn, N. Y. It consists in covering the wood with plain sheet metal, then passing the pole and covering through a hollow revolving chuck, with a point or tool to run in contact with the metal for impressing on it spiral ornamentation and embedding it into the wood.

A bow for musical instruments has been patented by Mr. Daniel Nettekoven, of Fort Shaw, Montana. The invention covers a tapering pocket in which are placed the ends of the hair, and a wedge fitting into the pocket, with other novel features, whereby the hair can be quickly removed and replaced, and is not liable to become loose in its fastenings.

A sofa and bed lounge has been patented by Mr. James P. Miller, of Boston, Mass. The seat has a back hinged to it and legs hinged to the back, with a spring secured to the seat and connected to the legs, for holding the back in a vertical position, with other novel features, so that but very little exertion will be required to convert the lounge from a sofa to a bed, and *vice versa*.

A water heater has been patented by Messrs. Julius Helm and William H. Sweaney, of Williamsburg, Va. It is for heating water for bathing, laundry, or agricultural purposes, and the invention consists in a novel way of placing a stove constructed therefor in the end of a bath tub or other water receptacle, so that the water will partially surround the stove and be directly heated thereby.

A combined watch key and chain bar has been patented by Mr. Sherburn L. Swasey, of Newbury, Vt. It consists of a series of steel strips fixed in a barrel, the ends projecting from the barrel, and the inner sides of the strips shaped to form a square bore, which decreases in diameter from one end of the key to the other, the tubular barrel or bar having a chain-attaching ring secured between its ends.

A pipe bending machine has been patented by Mr. George B. Brownson, of North Springfield, Mo. Combined with a semicircular grooved block and grooved supporting blocks on pivoted dovetailed heads, adjustable at desired distances apart, are suitable means for moving the semicircular bending block down upon the pipe resting on the supporting blocks on the portion between the points of support.

A staff holder has been patented by Mr. Joseph Husband, of Rockwood, Ill. It is a device for holding brooms, canes, and similar articles, and consists of a base board with a horizontal shelf, with jaws pivoted to the shelf, a pair of levers pivoted to the base board, and a rod connected with the levers and having a socket for receiving the end of the broom handle or other article.

A combined door bell and letter box has been patented by Mr. John H. Pierce, of Omaha, Neb. This invention covers a bell-striking mechanism and mechanism for locking the letter box, the opening of which is closed by a flap plate adapted also to receive a name, above which is a push button of glass, hollow, and filled with a wooden plug painted with luminous paint so it will be visible at night, with other novel features.

A hat felting machine has been patented by Messrs. James C. Grant and Jarvis C. Brush, of Newburg, N. Y. The invention consists principally in connecting the sizing machines by a conveyer leading from the discharge opening of one machine to the feed opening of the next succeeding one, thus rendering the felting continuous and obviating the necessity of the operator's transferring the hat bodies from one sizing machine to another.

A sewerage system for buildings has been patented by Mr. Charles H. Shepherd, of New York City. It embraces a receiver for taking the waste and delivering it to the sewer pipe, there being in the receiver a broom for stirring up and discharging accumulating matter, with means for flushing the receiver and applying disinfectants thereto, and devices for drawing a soil pipe cleaning brush through the pipes, while preventing entrance of sewer gas to the building.

A mechanism for transferring patterns has been patented by Mr. Isaac Marks, of New York City. A leaf carrying the pattern in embossed or raised outline is hinged to a cutting table or other suitable bed, on which the cloth to be marked is placed; the raised pattern on the leaf is then covered with chalk or other marking material, the leaf turned down upon the cloth, and a roller specially arranged therefor made to travel over the back of the leaf, thus marking the pattern on the material.

An apparatus for launching torpedoes and an automatic brake therefor have been patented by Mr. Emil Kaselowsky, of Berlin, Germany. The launching device is a bar or beam that may be extended outward from the torpedo tube, and having a guide that conforms to a guide stud on the outer surface of the torpedo, so that as the torpedo leaves the case the projection will enter the slot in the guide bar, and the torpedo be thus supported and guided until it has entirely emerged from its tube, while the brake-releasing mechanism operates automatically simultaneously with or slightly before the application of the projecting force to the torpedo, in order to avoid the possibility of compressed air or gas, or similar projecting force, being admitted to the torpedo tube while the brake is applied.

NEW BOOKS AND PUBLICATIONS.

AGRICULTURE IN SOME OF ITS RELATIONS WITH CHEMISTRY. By F. H. Storer. New York: Charles Scribner's Sons. 2 vols. Pp. 529, 509.

While this is a work written for persons fond of rural affairs, and students of agriculture, it is not at all technical in the chemical information given; its character may be best judged by the fact that it is based upon lectures delivered by the writer, who is Professor of Agricultural Chemistry at Harvard, for two classes of students—young farmers and city men desiring acquaintance with land cultivation as connected with suburban homes. As is to be expected from this mode of treating the subject, the 1,000 pages of matter here presented furnish interesting reading throughout rather than dry technical details, although each chapter furnishes an epitome of the most recent and valuable information on some one branch of the study. The general relations of soil and air to the plant, the atmosphere as a source of plant food, and the movements of water in the soil, form the opening chapters, followed by a description of the instruments and operations of tillage, a consideration of soils as chemical agents, composting and the best ways of applying manures and fertilizers, the nitrates, phosphates, and ammonium compounds, lime, sodium, and magnesium and their compounds, with chapters on irrigation and draining, the rotation of crops, and special cultivation of hay, oats, barley, care of pasture land, etc. To one new to the subject, this work will furnish an invaluable guide, while the experienced agriculturist cannot fail to be benefited by its logical reasoning and rich store of clearly arranged facts.

BOILER MAKING. By W. H. Ford. New York: John Wiley & Sons.

This is a practical treatise on work in the shop, intended for the use of boiler makers, showing methods of riveting, bracing, staying, punching, drilling, smithing, etc. The descriptions in this little hand-book are so minute, accompanied as they are with illustrations showing the tools used and the best way of doing many kinds of work, details which workmen generally only acquire by long experience, that it cannot fail to be an extremely valuable assistant to the young boiler maker.

THE METAL TURNER'S HANDY BOOK. By Paul N. Hasluck. London: Crosby, Lockwood & Co.

This is an English manual for workers at the foot lathe, giving elementary information on the tools, appliances, and processes employed in metal turning. It is intended for the beginner, and has numerous illustrations, some of which are of styles of lathes and appliances differing somewhat from what one usually sees in this country.

Received.

LEVELING; BAROMETRIC, THERMOMETRIC, AND SPIRIT. By Ira O. Baker. New York: D. Van Nostrand.

ANALYSIS OF ROTARY MOTION AS APPLIED TO THE GYROSCOPE. By Major J. G. Barnard. New York: D. Nan Nostrand.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) R. M. A. asks how to harden small work, such as used in watches, so that it will come out clean and white, or how to remove the black scale, provided it does not come out clean. A. Put soap on the pieces before heating. Use muriatic acid 1 part, water 2 parts, for cleaning the pieces when made black by hardening.

(2) G. Y.—For information on incubators and regulators, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 54, 380, 425.

(3) H. H. asks: 1. All other things being equal, what makes the strongest electro-magnet—one composed of three pieces, two cores and back, or one composed of a single bar of iron bent in "horseshoe" form? A. The single piece of iron would be rather the stronger. 2. How must I wrap this magnet—with wire in sections, or in one winding? A. Sectional winding may be useful as a matter of convenience. We should not recommend it as increasing the power. 3. In the Holtz machine described in SUPPLEMENT, No. 278, are both inductors applied to their respective windows on the same face of the eye glass, or is an inductor first applied, and then the plate of glass turned over so as to lie on its opposite face, and the other inductor then applied? When both plates are in position on the machine, are the inductors—if both are on the same face of the glass—on the face farthest away from the revolving plate, or on the side nearest to it? A. The inductors in the Holtz machine are on the same side of the glass plate—the side farthest from the revolving plate. 4. Will a magneto machine run an induction coil? If so, must a current interrupter be used? A. A magneto machine will run an induction coil without an interrupter.

(4) Wm. asks: Was there ever a time in the last 100 years when a double eagle meant $100? A. No, but the double eagle of 1849 sells to-day for $300, on account of its rarity.

(5) F. K. desires a receipt to make beef wine, and iron, as made and sold by the apothecaries. A. Liebig's extract of beef ½ ounce av., ammonio citrate of iron 256 grains, spirit of orange ½ fl. oz., distilled water 1½ fl. oz., sherry wine sufficient to make 16 fl. oz. Dissolve the ammonio citrate of iron in the water, dissolve the extract of beef in the sherry wine, add the spirit of orange, and mix the solutions.

(6) W. C. asks: What is the difference between a dynamo-electric machine and a magneto-electric machine? A. The dynamo has its magnetic field established by an electro magnet; the magneto, by a permanent magnet.

(7) C. B. N. asks about the "Legion of Honor" of France. A. It is an order founded by Napoleon, May 19, 1802, as an especially honorary recompense for services rendered to the state. The decoration consists of a five rayed star, bearing the imperial effigy and eagle and surmounted by the imperial crown.

(8) W. H. R. asks: 1. What is the speed of Ericsson's Destroyer? A. We believe the trials thus far have not settled this question. 2. Which is considered the best—the Armstrong, Krupp, De Bange, or Whitworth system of artillery? A. Each of these systems has its peculiar advantages. We do not yet know which is to take the lead. 3. What is the rule for calculating the range of a gun, when the velocity and weight of the projectile are known? A. The problems pertaining to projectiles are rather complex, but fully given, with examples, in "A Treatise on Practical Mathematics," Chambers' Educational Course, $1.50, which we can furnish. The formulas are:

h=Height due to velocity of projection.
v=Velocity of projection in feet per second.
r=The range required.
e=Angle of elevation.
g=Gravity=32·2. Then

$$h=\frac{v^2}{2g}\quad r=2h \sin, 2e$$

For example: A ball discharged at a velocity of 1,500 feet per second, at an elevation of 24° 36′, required the range.

$$\frac{1{,}500^2}{2\times 32\cdot 2}=34{,}938=h, \text{ and}$$

69,876×0·756995=52,896 feet, or 10 miles. Use the table of natural sines. 4. Have mortars been improved as much in the last twenty years as cannon? A. Mortars are out of date, both shells and solid projectiles being fired from the great guns now made. 5. What is the name of the most powerful war ship at present afloat? A. There is considerable doubt as to which of some three or four of the European war ships would be the most powerful in actual battle, which would give the only practical test. 6. I have a microscope of the Student class. The body and draw tube are not blackened inside. Should this be done? The definition of this microscope is good in the day time, but bad by lamp light. What is the cause? A. The microscope should be black inside. Probably you do not understand the management of the light. We can send you a book, "How to Use the Microscope," by J. Phin, 75 cents.

(9) H. K. B. asks: What size and length of wire would be best to use in constructing the Deprez galvanometer (described in your issue of December 4). If a single magnet of good strength, and 7 inches high, ¼ inch thick, 1 inch between the poles, and each pole piece or arm of the magnet is 1 1/16 inch in width, be used, could it be made to work well with such a magnet? The galvanometer is to be used in circuits of medium resistance, and to test the relative strength of different battery cells. Is it absolutely necessary to use silver wire to suspend the coil by, and will the deflections be directly proportional to the current strength? Also what is the soft iron cylinder for, and must the iron be very soft? A. The best way is not to depart from the dimensions given, which represent the results of good practice. Your magnet would probably answer. Adhere to the sizes of wire given for the coil. You can only use it on extremely weak currents or as a volt meter. Any attempt to use it directly as an ammeter will destroy it unless the current is very slight. Silver wire is far the best for suspending it. The soft iron cylinder becomes polarized and increases the intensity of the field. It should be good quality wrought iron. The deflections will only be proportional to the current strength when used by the discharge method, and it is not very reliable for this work.

(10) B. F. S. asks: What is the best, but simplest, method of tempering mill picks? Please give us two or three ways of doing same. The smiths here do not have success, and we want a method of doing it ourselves. A. The tempering of mill picks is more a matter of care and observation than any special material used in the process. More picks are spoiled by burning or overheating the corners than by any other part of their manufacture. A slow fire and heating back from the point is an essential feature. Do not draw the edge thin. Leave it a little blunt and grind for the proper edge. Heat to a cherry red, no more at the corners than in the middle. Dip in clear water, and draw the temper to a full straw color. Brighten the edge surface on a grindstone or with emery paper before tempering. See valuable articles on Hardening and Tempering Tools, by J. Rose, in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 95, 103, 105.

(11) C. S. S.—Wood steeped in a solution of copperas becomes harder and more indestructible.

(12) J. F. D. desires (1) a receipt for cheap paint for old shingle roofs. A. Coal tar paint would be the cheapest thing you can use. See a "Recipe for Roofing Paint," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 113. 2. What chemical will make water and coal tar mix? A. You cannot make a perfect mixture of them.

(13) W. L. J. asks best material to put on ropes used in water (fresh), such as boom ropes. Also on ropes used in hauling logs out of boom. A. Immersing the cordage in a solution of 50 or 60 parts water and 1 part corrosive sublimate will tend to preserve the rope. As to use of tar, the best rope is not tarred.

(14) T. J. C. asks: What material is used for a matrix in casting celluloid stereotypes? A. Celluloid should not be cast, but becomes sufficiently soft at 165° Fah. to assume desired forms by pressing, which should be done in a brass mould, also heated beforehand, the article to be cooled off in the mould by cold water. When articles can be punched or pressed from the material, it should be heated in warm water to 100° Fah., to prevent tearing and splintering.

(15) D. P. B.—A mixture of coal tar and plumbago, thinned with turpentine or benzine, makes the best paint for an iron smokestack.

(16) P. M. asks for a paste not liable to be affected by liquids, vinegar, etc., for fastening a small glass disk in a metal cap. A. Boil 3 parts resin with 1 part of caustic soda and 5 parts of water, thus making a kind of soap which is mixed with half its weight of plaster of Paris.

(17) A. J. K. asks (1) a transparent ruby and a yellow colored varnish to cover glass with for photographic purposes. A. Use aniline colors mixed with collodion. 2. How to make a good negative varnish? A. Sandarac 4 ounces, alcohol 28 ounces, oil of lavender 3 ounces, chloroform 5 drachms. 3. What is the best process of intensifying a negative, and how done? A. Bichloride of mercury, saturated solution, in cold water. The negative should be placed in alum a short time before treatment. Wash negative well, and immediately pour on mercury solution; do not keep it on too long unless the negative is very thin. Wash well and immerse in a bath of water 10 ounces and ammonia 10 drops. Leave plate in this solution until the black color goes quite through the film. Wash well. If the mercury solution makes the negative too dense, dilute with water.

(18) E. R. S. writes: I have a "weeping sinew" between my first and second knuckles on my right hand. What will cure it? A. Paint it with iodine.

(19) Stencil Cutter, Ironton, O., asks: What is the best mixture to stencil name on stoneware, using a thin copper stencil, before burning? A. Cobalt oxide mixed to suitable consistency with linseed oil and japan.

(20) C. L. asks: What oil can I use to rub into my shoes at night, so that I can polish them in the morning by using ordinary shoe blacking? A. You cannot polish well over leather thus recently treated to soften it. The city bootblacks always find it hard work to get a "shine" on new boots or shoes. A mixture of neatsfoot oil and tallow, about one-half each, makes the best dressing for such use, and the leather should be slightly moist, but not wet, when treated.

(21) H. D. G. writes: 1. Cuff buttons worn on celluloid cuffs color them. What will remove the coloring without injury to the cuff? A. The spots can be removed by washing with sapolio or other suitable soap. 2. Why do cuff buttons color or stain celluloid cuffs, and not linen? A. It depends on the composition of the cuff buttons. Linen cuffs are often stained by their gold stems.

(22) M. B. L. asks: What kind of ink or crayon will resist acid on copper or zinc? A. Use a black asphaltum varnish, procurable at any first class paint store.

(23) H. O. T. asks for the best mode of finding or tracing trichinæ in pork by means of a microscope. A. Cut a very thin longitudinal slice of the muscle by means of a very sharp knife or razor. Press it between two glass slips, and examine by transmitted light. The coiled trichinæ may be readily distinguished from the muscle fiber.

(24) S. S. asks whether frictional electricity can be generated on a damp, rainy day. If so, in what proportion to a dry, clear day? A. Practically speaking it cannot, as moisture in the air conducts it away; in many cotton factories, arrangements are made by spraying to impart some moisture to the air, in order to dissipate the electricity generated by the motion of the machinery.

(25) T. L. R. asks about the relative buoyancy of deep and shallow water, stating that a vessel drawing 12 feet will touch the bottom in passing over a shoal that is more than 12 feet in depth. A. There is no difference in the buoyancy of the water, but the swell caused by the vessel's motion has its corresponding depression, to which the vessel must settle, and this swell is greater in shallow than in deep water.

(26) Curiosity asks: 1. Will the government's new cruisers, in course of completion, be illustrated in your paper? A. We have illustrated some—see SUPPLEMENT, No. 555—and shall continue as hitherto to do so. 2. Has the government enough heavy armament, viz., 54 ton guns, to equip all of the new vessels? A. No; many new guns have yet to be built. 3. Suppose an enemy's vessel carrying 100 ton guns should fire a shell at long range, and explode same within a very few feet of the vessel which is to carry the pneumatic guns and 12,000 pounds nitroglycerine, would there be any danger of the concussion exploding the nitro-glycerine? A. The concussion from an exploding shell would not be enough to explode explosive gelatine. Lieut. Zalinski has made exhaustive experiments on this point, and has proved its absolute safety from explosion by aerial concussion of gunpowder, fulminate, or other explosive. 4. Please give relative strength of France and Germany, both on sea and land, at present time.

A.

France.	
Army	497,458 men
Gendarmes	25,285 "
Navy	410 ships
	42,789 men
Germany.	
Army	445,417 men
Armorers, etc	3,918 "
Navy	98 ships
Besides torpedo boats built and building, which are to amount to	150 vessels
	17,426 men

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

April 26, 1887,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Aerial navigation, W. Beeson ... 361,855
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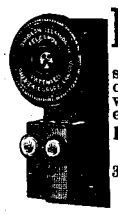
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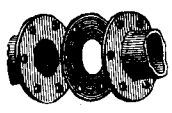
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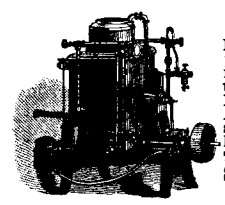
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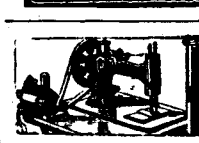
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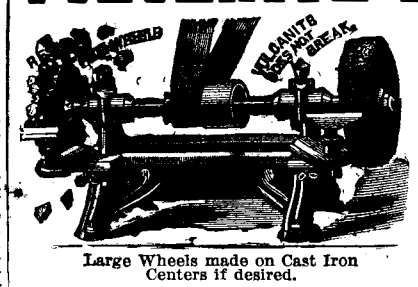

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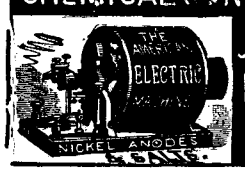

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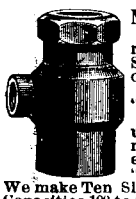

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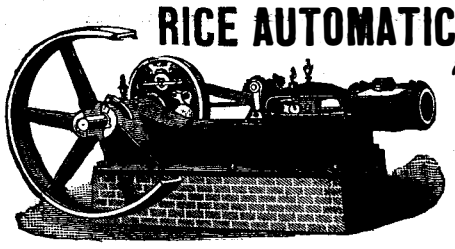

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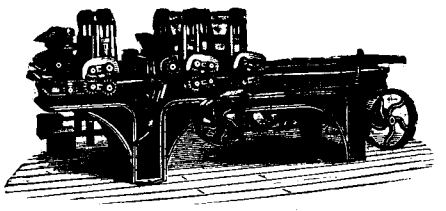

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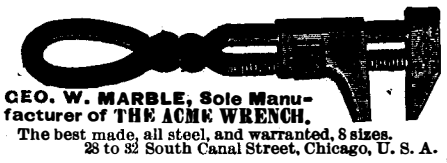

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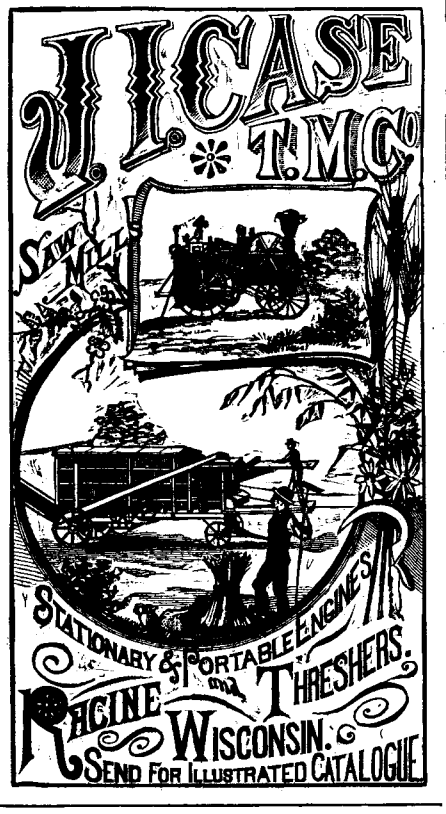

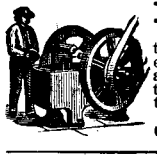

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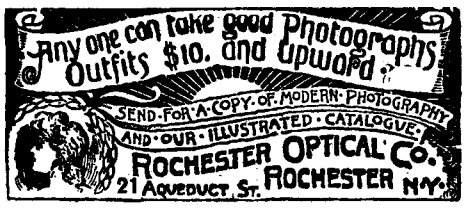
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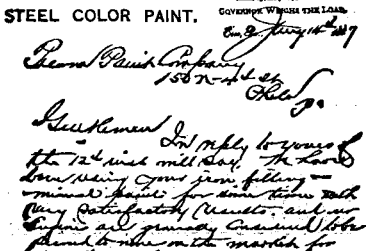

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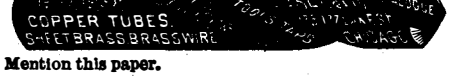

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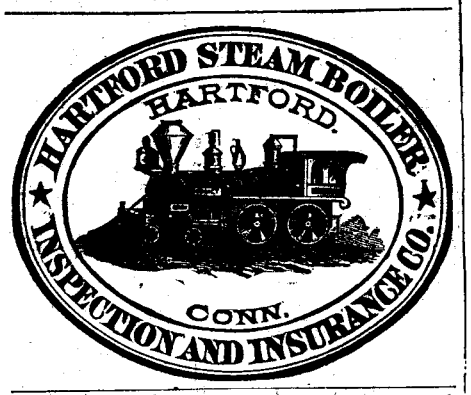

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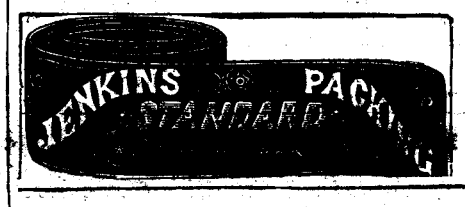

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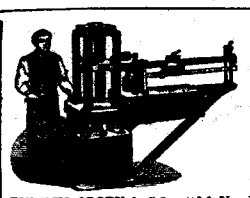

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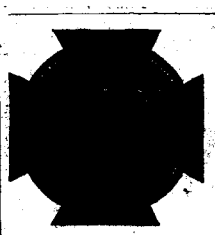

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